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The OIL AND GAS JOURNAL

OCTOBER 13, 1958

EXPLORATION SECTION p. 179

CURRENT STATISTICS p. 207

A Look at Drilling in 1958

. . . the industry needs 1,037 completions a week during the fourth quarter to meet programs outlined early this year. **p. 69**

Multiple Completions Will Grow

. . . now that new equipment and better state regulations make multiples economical. **p. 74**

Automatic Data Handling

A special section on data-logging techniques and how they are being used in the oil industry.

p. ◀91▶

"FORECAST OF THE FUTURE"

To forecast the present and future productivity of a well requires the solid foundation which is provided by oil well cementing.

For nearly half a century, Halliburton Oil Well Cementing Services—through progress, research and experience—has made available to oilmen in every corner of the world, the tools, equipment and products necessary to help establish the beginning and future existence of thousands of producing wells.

With only one basic philosophy . . . to serve the well owner in his every need . . . Halliburton will continue to aid in forecasting the requirements necessary for the future growth of the oil industry through its proven pattern of progress and research.

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Oct. 13, 1958

Early prediction for 1959 all tend to be bullish:

Oil men attending industry conventions are picking up doses of optimism from visiting economists.

Dr. Pierre Rinfret, economist for a New York investment counselor, tells drilling contractors 1959 will set a new record for overall economy. He sees a good fourth quarter this year with the Federal Reserve Bank Index late in 1959 rising above its high point of 146.

For oil, Dr. Rinfret predicts a 3 to 4% increase in demand in 1959, a 5% increase in capital expenditures. This gain in spending will show up especially in drilling and production segments.

Over the next 5 years, a moderate growth of 3% a year in oil demand is the prospect.

An even better prediction of 6% gain in demand for oil during 1959 was made earlier by Chase Manhattan Bank Economist John Winger.

▼ ▼ ▼

A limit on drilling activity even under improved oil industry conditions is resulting from these trends:

...Multiple completions are catching on fast.

...Wider well spacing for oil exploration.

...Emphasis on gas drilling which traditionally has enjoyed much wider spacing.

These mean fewer wells will be needed to do the same job.

AAODC President J. U. Teague advises contractors in a farewell speech it will be a long time again before a demand for 3,000 active rigs will be reached in the U. S.

His advice: Adjust your business to the present rate of drilling as nearly normal.

Look for the wider-spacing movement to grow.

Reason: Cost cutting. The oil industry is faced with the necessity of lowering its drilling and production costs.

Two events last week point up industry thinking:

Texas Mid-Continent Oil and Gas Association heard its president, Charles W. Alcorn, recommend wider spacing for developing fields to free extra money for wildcatting.

Oklahoma Corporation Commission at its hearing on new

field rules heard Phillips Petroleum Co. urge that number of unnecessary wells be reduced by wider spacing, especially in early development of pools.

Drilling statistics indicate operators again have cut their well programs in the last half.

Completions are running at average of 971 wells weekly in September, highest since January.

But operators will have to complete 1,037 wells weekly the rest of the year to meet the program they outlined at mid-year. October and November should be good drilling months but not that good.

Guess now is that total wells will be 48,400, about 550 short of the original program (p. 69).

Longest string of casing ever set in Canada is claimed for Shell's Burnt Timber wildcat in Foothills belt of Alberta.

Shell put 14,958 ft. of 7-in. pipe into the hole, located 70 miles northwest of Calgary.

Information on well is tight until a reservation sale is over involving a 11,920-acre block 20 miles southeast of Burnt Timber.

▼ ▼ ▼

Contract for drilling and developing three Argentine producing structures will go to Kerr-McGee.

Details were being wrapped up in New York at week end by officials of Kermac and Carl M. Loeb, Rhoades & Co., the investment bankers who have an over-all $100-million deal with Argentina (OGJ, Sept. 8, p. 83).

The Argentine state oil agency, YPF, has assigned the structures to the bankers who are dealing with Kermac to do actual field operations. Rumors in New York also say Kermac is buying a slice of the deal.

Another rumor in New York: Ferrostal, A.G., the big German pipe maker, has completed an independent deal with YPF to supply $150-million worth of pipe, tubing, and equipment for Argentine oil development.

Several American and foreign syndicates are negotiating for deals in Argentina. So far only the Loeb group, Pan American International and Union Oil Co. of California have completed contracts.

Petrofina is making plans to get another slice of Venezuelan territory if the government decides to grant further concessions.

Caracas reports indicate Petrofina has bought a 25% interest in geophysical work already done by Superior Oil in Barinas and Eastern Venezuela. Belgian firm also will foot a fourth of the bill for future exploration work.

In return Petrofina gets a quarter interest in any concessions granted Superior.

Oil now knows what to expect from Nasser.
The Nasser-dominated United Arab Republic last week cancelled drilling concession in Syria held by American interests, banned all future activity of company (p. 86).
At stake was a new oil field found by Americans.
This blow came after Cairo set up a new governmental authority to control all phases of oil in Syria and Egypt.
Speculation is that Cairo will take over Syrian field and develop it with Russian equipment and technicians.

Portents of future trouble in Venezuela may be mirrored in recent Petroleum Workers convention, first since ouster of Dictator Marcos Perez Jimenez.
At least 27% of delegates were communist, according to a local press evaluation of political makeup of the delegates. Rest were from left-wing parties.
The labor convention recommended a minimum 75-25 profit split from oil for the government, no new oil concessions, a review of the 1956-57 concession awards, and creation of a national oil company and tanker fleet.

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For pipeliners here's some news on pipe:

A plastic coating which Consolidated Western Steel has been testing for some time looks good for economical application at mill either inside or outside the pipe. Development work is still going on.

Add pipe mills to list of industries using TV.
The technique involves placing a TV camera inside the pipe to pinpoint the inside-diameter weld in making submerged-arc welded pipe from plates.

New method for x-ray examination of line pipe is in the advanced experimental stages.
This National Tube development doesn't require film, may reduce x-ray cost both on mill and field welds.

▼ ▼ ▼

Refiners have achieved another first in computer use.
An IBM 650 computer has been used to optimize operations of an entire refinery. It told which combination of conditions would yield greatest returns from given group of processing units.
Job was done with roughly 100 equations and as many unknowns covering operations of several processing units. It

is saving management several thousand dollars daily.

Simulation—using computers to show what units will do under certain conditions—is practiced in many refineries. But this is the first refinery-wide use of optimization.

Warning on indiscriminate use of electronic computing and data-processing equipment, meanwhile, has been sounded by a West Coast expert.

His advice: Use the complicated and expensive equipment only after you have determined if it is really needed and after you have learned to use it effectively (p. 84).

SunOlin has made its bow as new petrochemical company.

It's jointly owned by Olin Mathieson and Sun Oil.

New firm plans a 73,000-ton per year urea plant at Marcus Hook, Pa. Nitrogen for the plant will come from Sun's 300-ton per day ammonia capacity based on reformer hydrogen.

▼ ▼ ▼

Gulf Oil Corp. has started a sweeping decentralization.

All domestic producing operations will be transferred to a new headquarters to be set up in Houston.

Gulf now is in the process of dissolving its three division offices—in Tulsa, Fort Worth, and Houston. After this, all activities will be carried out by about 12 district offices. They will report directly to Houston.

Under new administrative plan, Pittsburgh will continue to set over-all policies. A domestic budget will be assigned to Houston headquarters. This will then be split up among the district offices. These districts will be virtually autonomous with major decisions checked up to Houston.

▼ ▼ ▼

OCAW is ready to take less than its announced wage goal.

How much less is open to bargaining.

But union officials have passed the word to local units to advise oil company employers that the union will consider realistic counter proposals.

This is the latest union move to get wage talks off dead center.

The shortage of engineers is due a quick return.

Or did it ever leave?

Latest report by government manpower experts is that industry in June will need 50,000 new engineers. But only 39,000 will be graduating from U. S. colleges.

But even in worst of recent unemployment period, U. S. Labor Department listed 2,900 jobs as going begging for civil, electrical, and mechanical engineers.

The Oil and Gas Journal is published weekly by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-class postage paid at Tulsa, Okla. United States and foreign rates to the petroleum industry, 1 year $5, 2 years $8, 3 years $10.

Good Wells Make Good News

A Monthly Report of Successful Well Treatments

October 13, 1958

Acidizing has come a long way since its use was limited to wells producing from simple limestones. Today, Dowell offers acids for many kinds of formations, from fast-reacting vugular or fractured limestones to slow-reacting dolomites and dirty sandstones. In addition, acids are available with addition agents designed to remove or prevent nearly every kind of permeability block. Here are four recent examples of special Dowell acidizing jobs:

- **Beaver County, Oklahoma.** (New Gas Well) This well was completed through perforations into the Chester lime from 6869 to 6927 feet. Two Dowell treatments were used. First, 1000 gallons Mud Acid was pumped down the casing to clean up perforations. In the second treatment, 20,000 gallons low-surface-tension acid was pumped down casing at 40 bpm. Treating pressures during last treatment ranged from 1550 down to 1000 psi. Before treatments well tested 3660 mcfd. After Mud Acid, it tested 20 mmcfd. *Following the final acid treatment, it tested 78 mmcfd.*

- **Alberta, Canada.** (Old Oil Well) This well was originally completed in 1950. The producing formation was the D2, and completion was open hole from 5000 to 5040 feet. Well had produced about 90,000 barrels of oil in eight years; but, at this point, production was nil and fluid level in the well was only 65 feet. The producer then had Dowell acidize using 5000 gallons Retarded Acid. Average injection rate was 5 bpm at pressures ranging from vacuum to 2200 psi. *One month after treatment, production had leveled off at 100 bopd flowing. Gas-oil-ratio was 250.*

- **Big Horn County, Wyoming.** (Old Oil Well) This well had been producing from the Tensleep formation and was re-completed in the Embar lime. Laboratory tests of produced fluid indicated severe emulsion problems. Formation samples contained substantial quantities of sulfates. Dowell suggested an acid with a demulsifying agent plus calcium chloride. The demulsifying agent was proposed to prevent tough emulsions from forming. The calcium chloride was used to keep the acid from dissolving and re-precipitating formation sulfates. Well was treated with 6000 gallons acid with demulsifying agent and 17,500 pounds calcium chloride. *Before treatment, well swabbed 25 boph. After treatment, well tested 22 boph — flowing.*

- **Logan County, West Virginia.** (Old Gas Well) This well was completed open hole in the Big Lime formation from 2671 to 2713 feet. It had produced little gas even though the offset was good. To clean up and acidize the formation, the operator ordered this three-stage treatment from Dowell: (1) 1000 gallons regular acid with Deterger® added to suspend materials blocking the formation. (2) 4000 gallons Retarded Acid to extend drainage area in the fast-reacting limestone. (3) 3000 gallons regular acid with Deterger. Well had been producing 10,000 cfd. After treatment, it gauged over one million cfd. *Treatment costs were paid out in two weeks and entire well cost was recovered in five months.*

Let your Dowell engineer help you "tailor" an acid treatment for your well. For service or more information, call any of the 165 Dowell service points and offices. In Canada, contact Dowell of Canada, Ltd.; in Venezuela, contact United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

Services for the oil industry DOWELL

A SERVICE DIVISION OF THE DOW CHEMICAL COMPANY

the OIL AND GAS JOURNAL

OCTOBER 13, 1958 • VOLUME 56 • NUMBER 41

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POSTMASTER: Send notification (Form 3579) regarding undeliverable magazines to The Oil and Gas Journal, 211 S. Cheyenne, Tulsa 3, Okla.

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SPECIAL DATA-LOGGING SECTION

Pinboard Technique Gives Flexibility to Data-Handling Systems 91

By Jack T. Teed

This enables the operator to substitute one type of input for another, rearrange the sequence in which the inputs are laid out, change the range for input variables, and set span, zero suppression, and alarm limits.

Phillips' Sweeny Logger Helps Ethylene Unit Operators 97

By J. G. Allen and G. L. Smith

This is an exploratory installation operated in parallel using a conventional instrumentation system. The operator who has been freed from manual logging can take care of more important duties. Later the unit will be used for accounting, computing, and closed-loop optimization procedures.

Tidewater's Loggers Operate at High Efficiency 102

By W. G. Deutsch

The 12 process scanning-logging systems and tank-farm logger have been operating about a year. Early problems such as operator psychology and some mechanical difficulties have largely been overcome.

Reliability of Loggers Is Important Factor 105

By Henry S. Stover

The trend is toward solid-state components—transistors and magnetic cores—for greater reliability in longer operations.

Data-Handling School Provides Link Between User and Manufacturer 109

By Maynard Kuljian

A streamlined course is set up to acquaint future users with special techniques needed for data logging equipment.

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Process Costimating 114

How CATC Fights Corrosion in Offshore Tank Batteries 117

By R. M. Robinson

Corrosion protection system for this offshore mobile tank battery has been carefully designed to protect against external corrosion of submerged parts, in the splash zone, and in the atmospheric zone. Consideration has been given to internal corrosion in the ballast and oil storage tanks.

New Two-Way Process Sweetens Gas, Recovers Sulfur 120

By L. S. Reid and F. M. Townsend

This is a one-step process for conversion of hydrogen sulfide in sour gas to elemental sulfur. The process has been developed to the pilot plant stage.

Products Line Crosses the Andes 129

By Paul Reed

A key to the rugged operating conditions for the Oleoducto del Pacifico products line is found in static pressures of more than 900 psi. at two stations and 700 psi. at the final delivery terminal.

Miniature Plants on the Upswing 137

By George F. Russell and Larry Resen

Sixty-three plants, each of which processes 5 million cubic feet or less of gas per day, are now in operation.

The Refiner's Notebook 144

Blowout Prevention in Cold Country 147

By David L. Black

The key is a hydraulic system which will not freeze at sub-zero temperatures.

Light Rig for Concentric-Tubing Jobs 150

By Ed McGhee

This special rig runs ¾-in. workover pipe inside production tubing. It is a real money-saver for some jobs.

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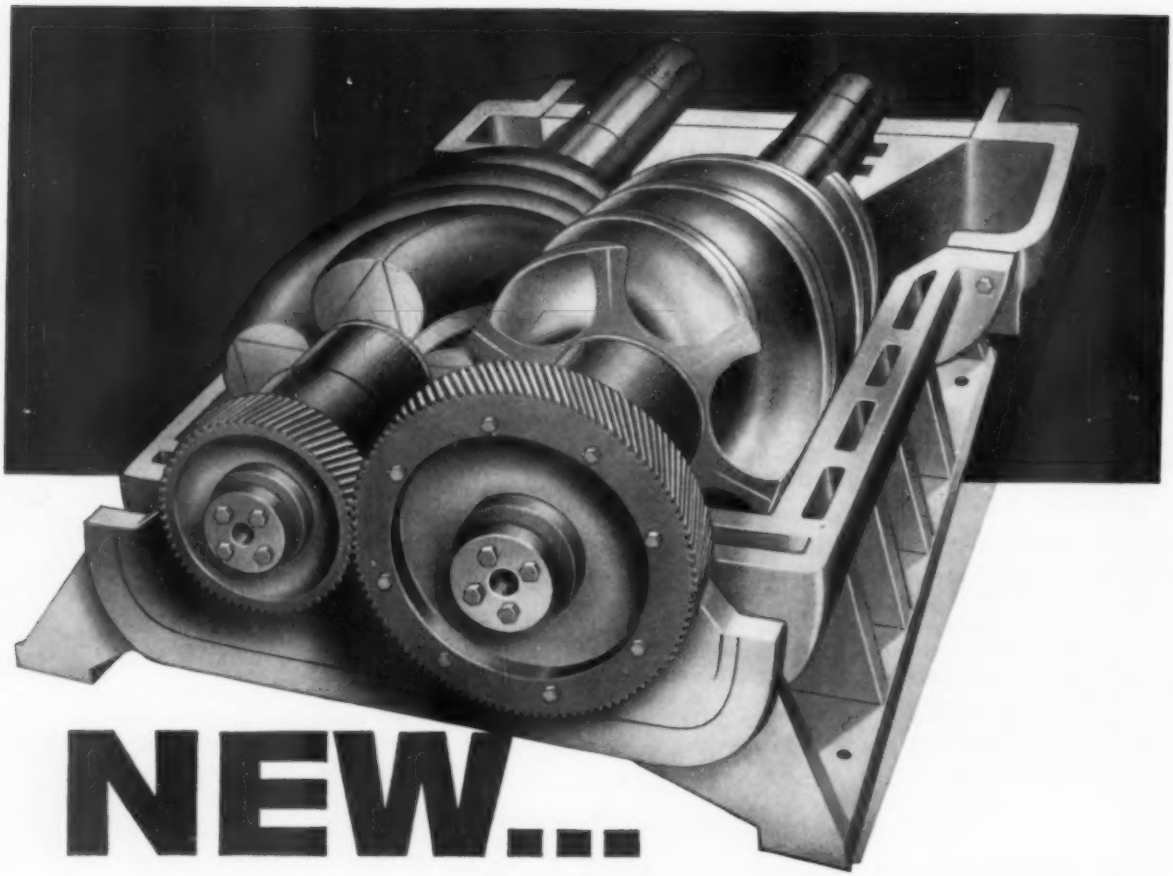

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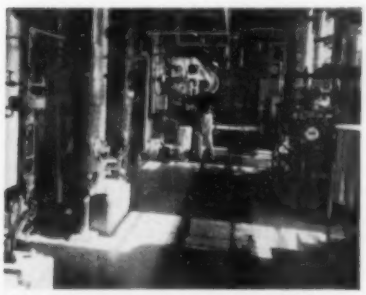

This is the powerhouse that had to maintain service, so that essential temperature control, in the laboratories it served, could also be maintained.

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Another new development using

B.F.Goodrich Chemical *raw materials*

Photo shows Kobe hydraulic oil well pump, made by Kobe, Inc., Huntington Park, California, being retrieved from well. "O" rings and packer cups of Hycar were supplied by Plastic and Rubber Products, Los Angeles, and The Guiberson Corporation, Dallas. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.

Hycar parts assure free bottom-hole pump efficiency

The Kobe bottom-hole pump with "O" rings and packer cups made from Hycar nitrile rubber has powered production from thousands of wells. Despite tough operating conditions, there has never been a failure of Hycar parts caused by temperature or pressure regardless of the time the pump is operated.

Parts made from Hycar are subjected to differential pressures in excess of 3,000 psi, to temperatures frequently in excess of 200°F. In some cases, these pumps have served effectively where temperatures exceed 300°F.

The Hycar parts must also withstand exceptional mechanical abuse, since they are often distorted by being forced through collar recesses of smaller diameter.

Here is another example of how Hycar nitrile rubber can help solve tough production problems. For more information write Dept. KC-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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"DM-DC" Drillable Squeeze Packer

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- Isolation of producing zones prior to perforation
- Correction of channeling problems
- Sealing off of low pressure thieving formations
- Abandonment of depleted producing zones

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TOOLS and TECHNIQUES for BETTER SQUEEZE CEMENTING

"DM-DC" DRILLABLE SQUEEZE PACKERS

Here is another excellent example of Halliburton's integration of tools and techniques. Simple and easy to set, these dependable packers run on drill pipe, tubing, drilling line or electrical well service wire line. When set by tubing or drill pipe, the circulating valve is free from packer before squeezing begins. Back Pressure Valve is closed as packer is set, providing positive fluid shut-off from below. Packer becomes a Bridge Plug when Sealing Plug or Ball is dropped or pumped in place after packer is set.

HALLIBURTON HYDRAULIC WIRE LINE SETTING TOOL

This new method requires *only* rig sand or drilling line to set Halliburton Drillable DM-DC Bridge Plugs and Squeeze Packers or Type "CL" Production Packers. Eliminates the special set-up and footage charge of wire line specialty company. Also saves expensive rig time as compared with setting packer on tubing. The setting tool can be used in wells with or without fluid since the hydraulic setting fluid is contained in the tool. Packer is set by hydraulic force from piston and cylinder arrangement which is actuated by reciprocating the wire line. The line pull required is reduced by the unique design of the piston areas. When sufficient hydraulic force is built up to set the packer, the setting tool frees itself for removal.

HYDRAULIC RETRIEVABLE CEMENTER (HRC)

Designed to perform efficiently under highest pressures and most difficult operating conditions. Simply operated and set easily by hydraulic pressure with automatic testing of tubing as packer sets.

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HR-4 CEMENT RETARDER

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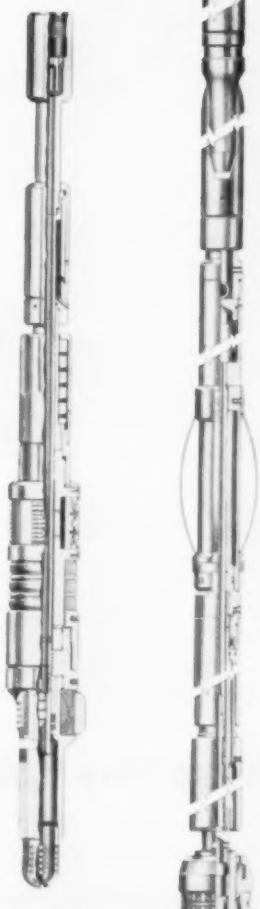
MCA (Mud Cleanout Agent)

Here is one of the industry's most effective mud dispersant solutions. Used ahead of cement slurry, it has proven helpful in obtaining successful water shut-offs because of its superior cleaning and dispersing properties.



Hydraulic
Retrievable Cementer

Wire Line
Hydraulic Setting Tool
w/ "DC" Bridge Plug

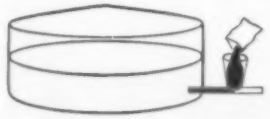
HALLIBURTON

CEMENTING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

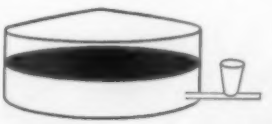
284 SERVICE CENTERS — JUST MINUTES AWAY FROM YOUR WELL

These tiny "Microballoon"* spheres have saved thousands of barrels of crude oil



1. "Microballoon" spheres are mixed with oil being pumped into the tank.

2. They immediately float to the oil surface, form a blanket in a few hours.



3. The blanket seals the entire surface within the tank, thus cutting evaporation loss.

For four years, leading oil companies have used these microscopic spheres of phenolic plastic to cut crude oil evaporation in working cone-roofed tanks—by as much as an estimated 80%.

By forming a floating blanket on the oil surface, "Microballoon" spheres provide an effective and economical way to equip a cone-roofed crude oil tank against evaporation loss.

To learn more about this method, write Dept. JG-O5E, Bakelite Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Toronto, 7.

*Registered trade-mark of The Standard Oil Co. (Ohio)

BAKELITE BRAND **RESINS**

UNION CARBIDE

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FR

Fatigue Resistant

LINK-BELT's answer to endurance demands on roller chain

THIS IS FR * By compressing the metal around pitch holes, Link-Belt greatly strengthens the critical sidebar areas most vulnerable to fatigue failure. This original development is the result of Link-Belt roller chain research and unequalled depth of oil field experience. FR is standard on Link-Belt oil field roller chain.

* U.S. Patent No. 2,517,497

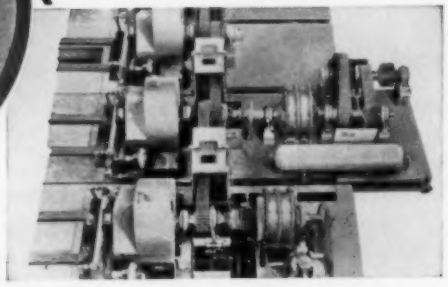
Greater sidebar Fatigue Resistance means greater dynamic strength... increased chain endurance

Today's high drilling speeds, great hook loads and heavy drill collar strings continually create a brute punishment no ordinary roller chain can long withstand. That's why modern rigs need Link-Belt roller chain with its vastly superior *dynamic strength* produced by the FR process.

This is just one of many "extras" you get in Link-Belt oil field roller chain. Others include:

- SHOT-PEENED ROLLERS with extra fatigue life.
- PRE-STRESSING for load bearing uniformity.
- E-Z ASSEMBLY to facilitate field installation.
- SHEPHERD'S CROOK COTTERS that won't shake loose.
- DOUBLE BOXING—most effective in the field.

For full information on them all, ask any leading supply store for your copy of Link-Belt Catalog 2780.

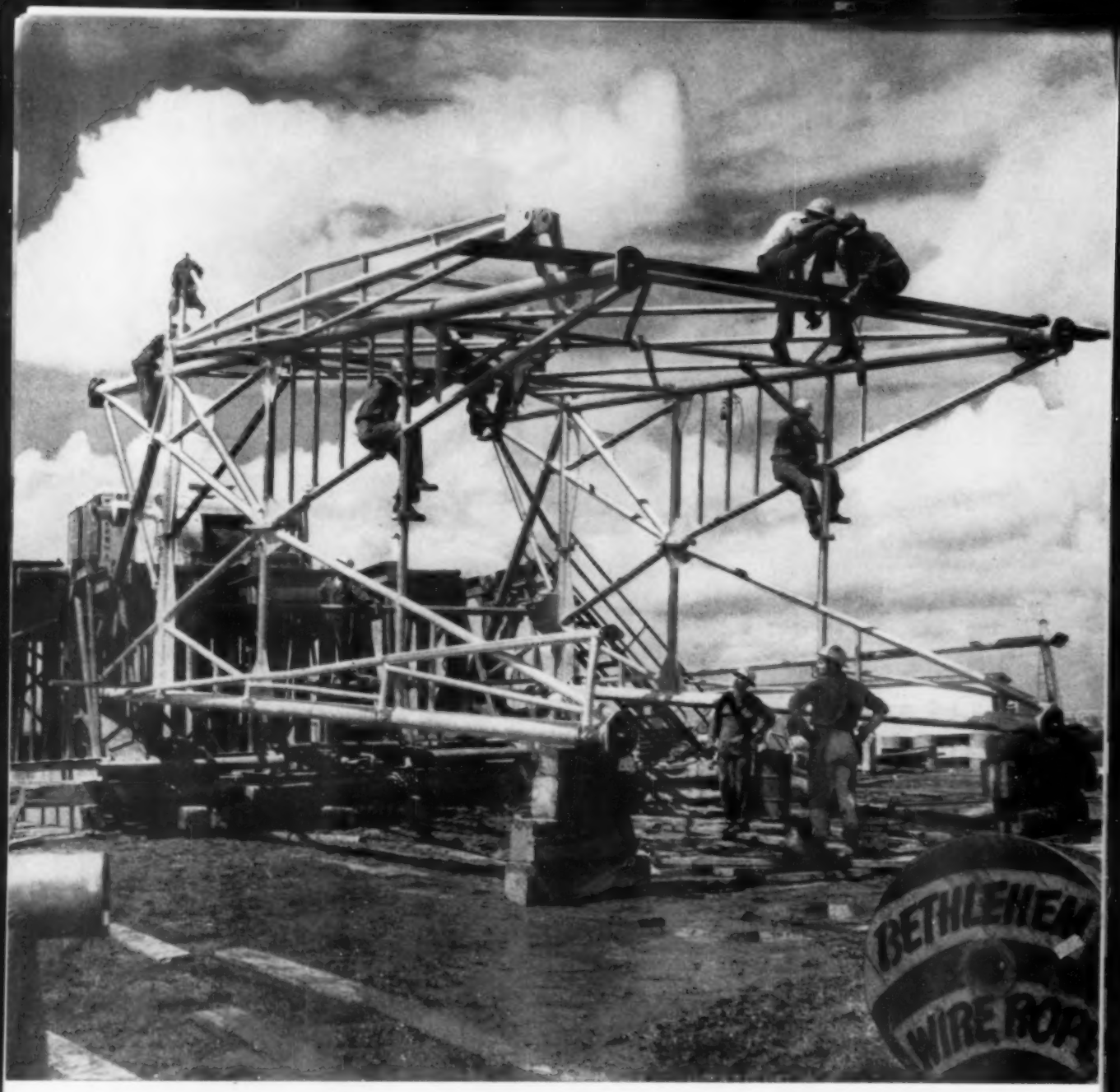


NATIONAL SUPPLY FOUR SECTION DRIVE GROUP, TYPE B-18G, incorporates Link-Belt FR roller chain—supplied as original equipment.

LINK-BELT

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 26, Odessa, Tex., New Orleans 16, Shreveport, La., Los Angeles 22 (Montebello), Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields. 14,817



Moving day for the workover outfit. Moving a workover rig is a task requiring skill, coordination, teamwork. But the crew can take it in stride, for a portable outfit is mobile as a circus and is handled in the same efficient way. This picture shows a rig being moved off a typical flowing well in southern Louisiana.

The workover specialists had just finished servicing the well, which was over 10,000 ft deep. The job of pulling and rerunning tubing was done with the rotary line, a Bethlehem Purple Strand rope with IWRC. Purple Strand was also the choice of the trucking firm engaged to load and move the rig. In both cases, the ropes were Form-Set (preformed) to insure good spooling and resistance to kinking.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

PETROLEUM • CONSTRUCTION • EXCAVATING • MINING • QUARRYING • LOGGING • MANUFACTURING

NOW IS NOT THE TIME FOR PIPE DREAMING

You can't afford to speculate with corrosion control!

Today you are tightening up on business operations. Risks are out. For pipeline protection, you can't afford to get away from time-tested corrosion control methods. Protective Coating Materials by Plastics and Coal Chemicals Division give you constant protection—superlative continuity, impermeability, bond, body strength, stability and chemical inertness. Made from highest quality coal-tar pitch—the shield that has proved best!

Proved and improved for three generations, these Pipeline Primers, Enamels and Auxiliary Protective Pipeline Felts form a lasting barrier against corrosive elements.

A staff of Field Service Experts are at your call to offer you technical assistance that can save you maintenance time and costs.

Always ask your applicator to use Protective Coating Materials produced by Plastics and Coal Chemicals Division. Write for full information.

PLASTICS AND COAL CHEMICALS DIVISION
Formerly part of the Barrett Division
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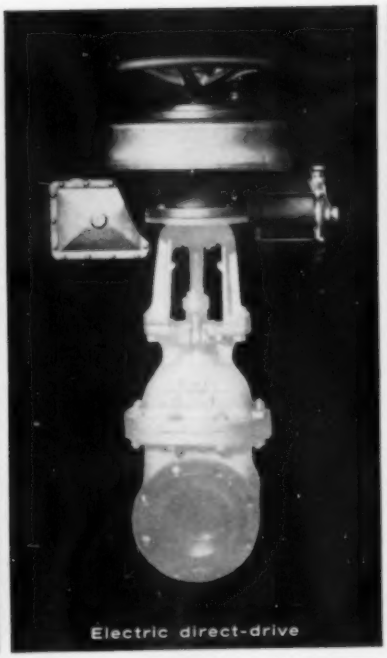
In Canada: Allied Chemical Canada Ltd., 1450 City Councillors St., Montreal

Allied Chemical

Electro-hydraulic



Electric direct-drive

Air-actuated

WHAT'S THE BEST VALVE OPERATOR FOR YOUR PARTICULAR JOB?

Obviously, there is no single operator which is "best" for every job. That's why General Controls offers all three, leaving the choice up to you.

Take the famous General Controls **HYDRAMOTOR**, for example. You'll find this powerful electro-hydraulic operator ideal for line sizes up to 8" for high-pressure, high-flow applications. Two-wire, slow-opening, fail-safe.

For the really big jobs, line sizes up to 60", it's the General Controls **TORK-MASTER**. This gear-driven electric operator can be adapted to new or old systems—*and with a minimum of costly down-time during the changeover.*

For heavy duty proportioning applications, you'll find the **HAMMEL-DAHL** air-operated diaphragm valve worth looking into. *And no electrical control or power circuits are required in proportioning operations.*

No matter which you select for your particular job, the important thing to remember is: *General Controls is a single source for all three types . . . and in all standard sizes.* For full information, expert field help, write today to

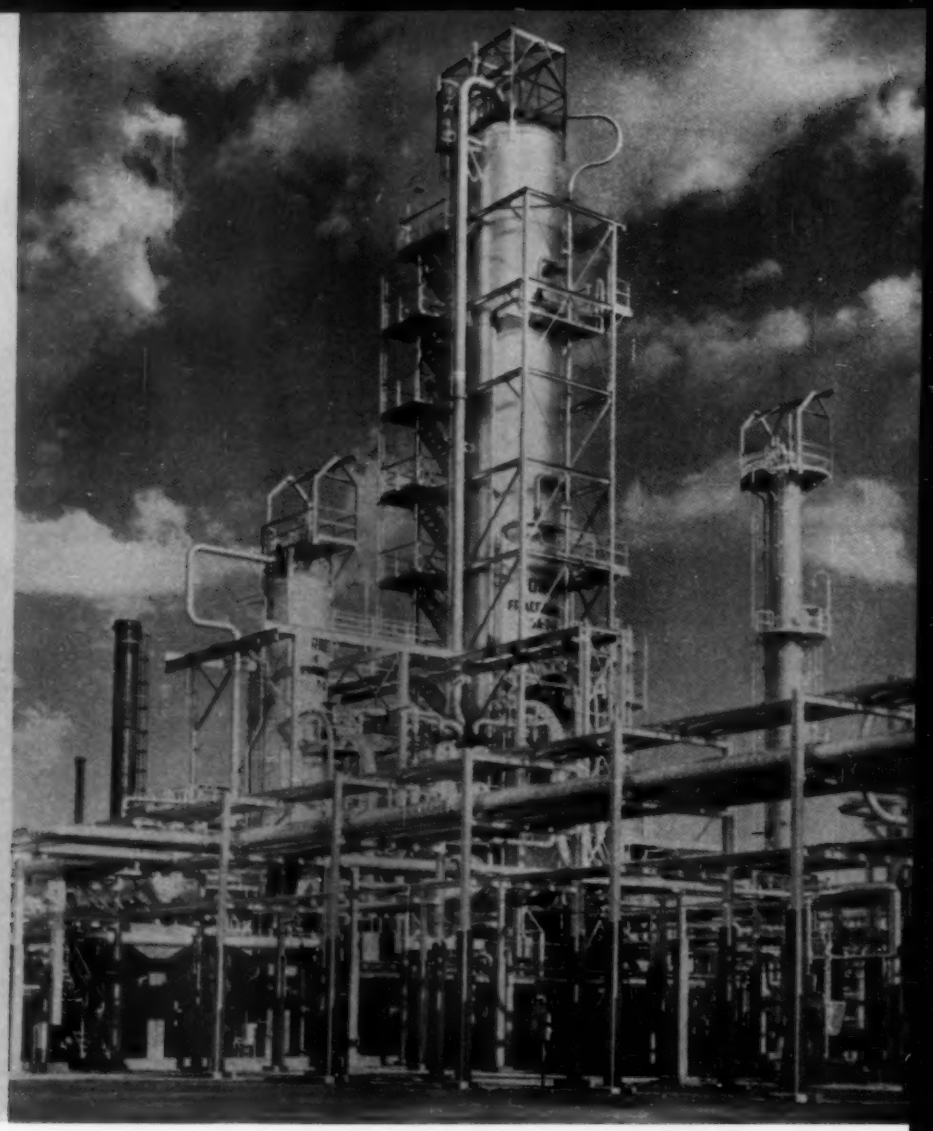
GENERAL CONTROLS

America's Finest Controls for Home, Business, and the Military

Glendale, California • Skokie, Illinois • Guelph, Ontario, Canada

In Plants—49 factory branch offices serving the United States and Canada

New Overseas Engineering-Construction Team



ARTHUR G. McKEE & COMPANY AND RAYMOND INTERNATIONAL INC. POOL WORLD-WIDE EXPERIENCE IN ENGINEERING AND CONSTRUCTION

In almost any foreign country, where you may plan to build a petroleum refinery or chemical plant, you'll find Raymond or McKee, or both, have already been on the job. Now the *combined* experience of the two organizations, working abroad as a team, can be invaluable to you in the design and construction of your overseas project. Familiarity with local laws, customs and conditions — direct knowledge of labor supply and transport in the far corners of the world — lines of communication established on previous contracts — these are important time and money-saving factors in McKee-Raymond services. The specialized talents and diversified skills of these internationally recognized leaders in engineering and construction are now available to you on a *single contract basis.*

Explore the potential value of McKee-Raymond teamwork on your new project. Write either Raymond International Inc., 140 Cedar St., New York 6, N. Y. or Arthur G. McKee & Company, 2300 Chester Avenue, Cleveland 1, Ohio.

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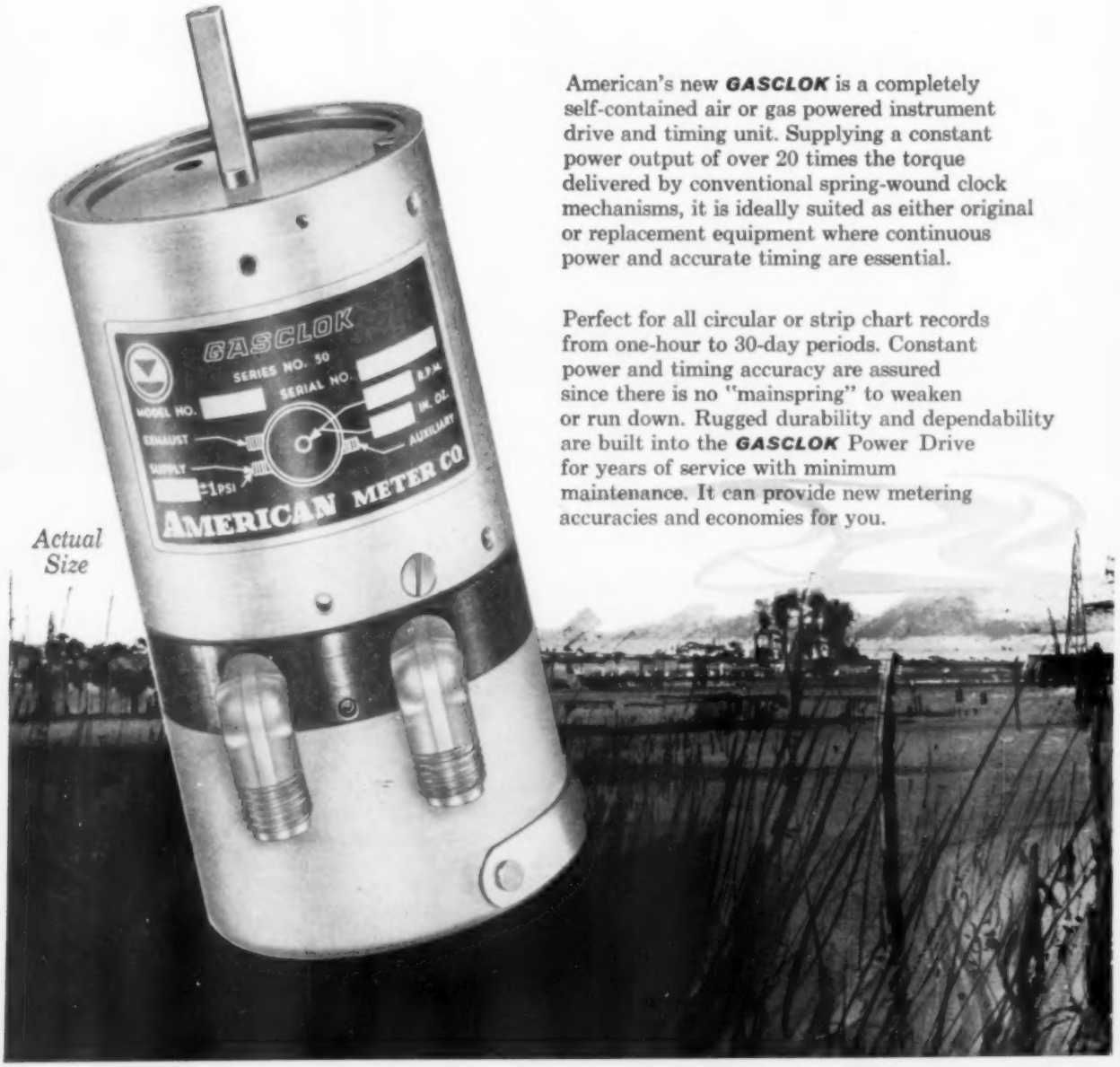
OVERSEAS ENGINEERING AND CONSTRUCTION SERVICES

NEW American®
GASCLOK Power Drive
constant high power • uniquely accurate



Actual Size

American's new ***GASCLOK*** is a completely self-contained air or gas powered instrument drive and timing unit. Supplying a constant power output of over 20 times the torque delivered by conventional spring-wound clock mechanisms, it is ideally suited as either original or replacement equipment where continuous power and accurate timing are essential.

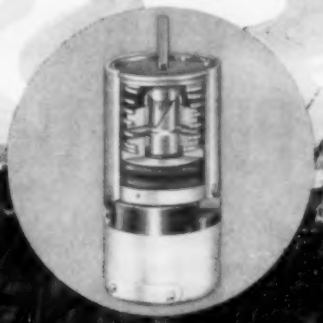
Perfect for all circular or strip chart records from one-hour to 30-day periods. Constant power and timing accuracy are assured since there is no "mainspring" to weaken or run down. Rugged durability and dependability are built into the ***GASCLOK*** Power Drive for years of service with minimum maintenance. It can provide new metering accuracies and economies for you.

for instrument driving and timing self-starting • air or gas operated

The versatile ***GASCLOK*** Power Drive is designed and field-tested for long trouble-free operation in remote location installations with all makes and types of recording instruments.

The high-torque, continuous drive provides power for: *Integrating Orifice Meters—Gas Lift Meters—Pressure Recorders Strip Chart Recorders—Telecounter Units—Field Program Timers* and many other instrument applications for accurate, automatic operation.

- **Self-starting mechanism completely self-contained—requires no winding or "priming" of power unit.**
- **Gas or air consumption only 5 cfh—normal operating pressure 5 psi—rotation 2 rpm.**
- **Timing escapement spring rewound every 5 seconds—eliminates fluctuating torque.**
- **Accuracy of timing unaffected by wide fluctuations in supply pressure.**
- **Timing mechanism internally sealed to prevent corrosion and clogging—all power unit parts exposed to gas are aluminum or stainless steel.**
- **Inherently explosion-proof.**
- **Large area internal ports to prevent plugging. All internal ports easily cleaned.**
- **Installation in any position—variety of mounting brackets available.**



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METER COMPANY
INCORPORATED (ESTABLISHED 1836)

AMERICAN METER CO EST. 1836 MEASUREMENT ENGINEERS

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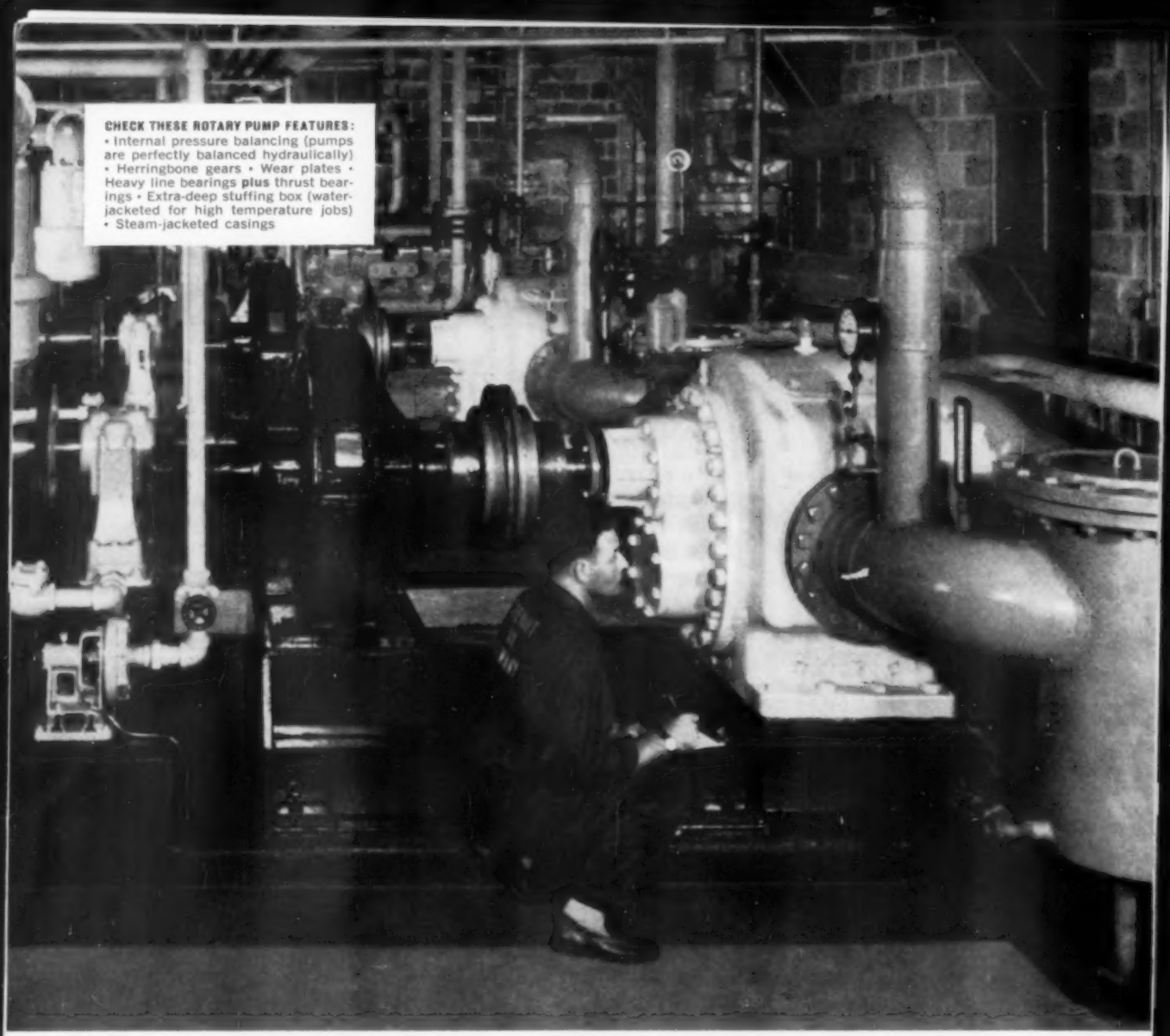
SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves


CHECK THESE ROTARY PUMP FEATURES:
• Internal pressure balancing (pumps are perfectly balanced hydraulically) • Herringbone gears • Wear plates • Heavy line bearings **plus** thrust bearings • Extra-deep stuffing box (water-jacketed for high temperature jobs) • Steam-jacketed casings

THE PUMP THAT PAYS FOR ITSELF

Greater efficiency, power savings make rotaries the pumps to use for medium and high viscosity service.

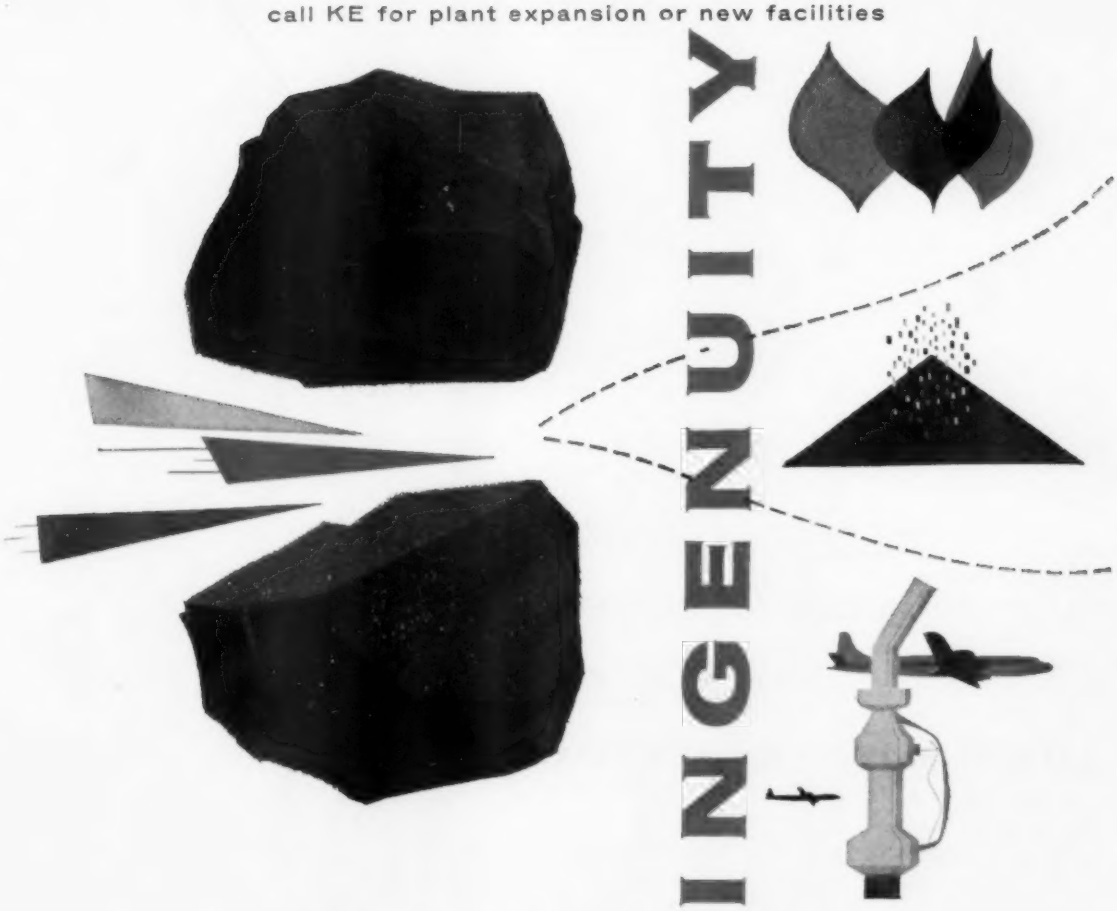
It's true rotary pumps cost a bit more than centrifugals . . . about 25% more. But that's purchase price only. You can quickly make up this higher first cost by applying rotaries on jobs they've been designed for. Such jobs are high-capacity oil transfer in tanker loading, gathering, or tank farms. As a matter of fact, you can even save so much the rotary will pay for itself!

True? Of course. Take this typical example. On medium viscosity crude oil a centrifugal pump might have an efficiency of 50%. A rotary pump performing the same service might have an efficiency as high as 80%, thus requiring *60% less power*. And electric power saving isn't all.

Rotary pumps are self-priming, and operate under very low absolute suction pressure throughout entire viscosity range. This means rotary pumps have low required Net Positive Suction Head (NPSH). They have the same high-speed smooth flow of a centrifugal pump, too, but have positive displacement. That is, they eliminate pulsating flow. And *only Worthington* makes rotary pumps as large as 16 inch suction and discharge. Ask your nearest Worthington representative for the full rotary pump story. Or, if you prefer, write to Worthington Corpoı tion, Section 20-4, Harrison, N. J. In Canada, Worthington, Ltd., Brantford, Ontario.

WORTHINGTON

call KE for plant expansion or new facilities



has made KE a major engineer-contractor serving Minerals and Petroleum

Nation's pioneer major commercial Gilsonite refinery near Grand Junction, Colorado... Another example of KE ingenuity.

Ingenuity at work—at American Gilsonite, Kaiser Engineers designed and built an enclosed, controlled-atmosphere calciner with associated power and plant equipment making possible 100% utilization of raw Gilsonite. First major all-commercial Gilsonite refinery built, the new plant produces 99.50% pure coke, extreme purity gasoline, and uses gaseous residue to power the entire facility.

From economic analysis through start-up, KE builds ferrous, non-ferrous, industrial minerals and petroleum processing plants; brings valued experience to every phase from mining and beneficiation to transportation and materials handling.

Let KE ingenuity save time and money for you. With your first thought of new facilities or expansion, call KE.

KAISER ENGINEERS engineers—contractors
Contracting since 1914

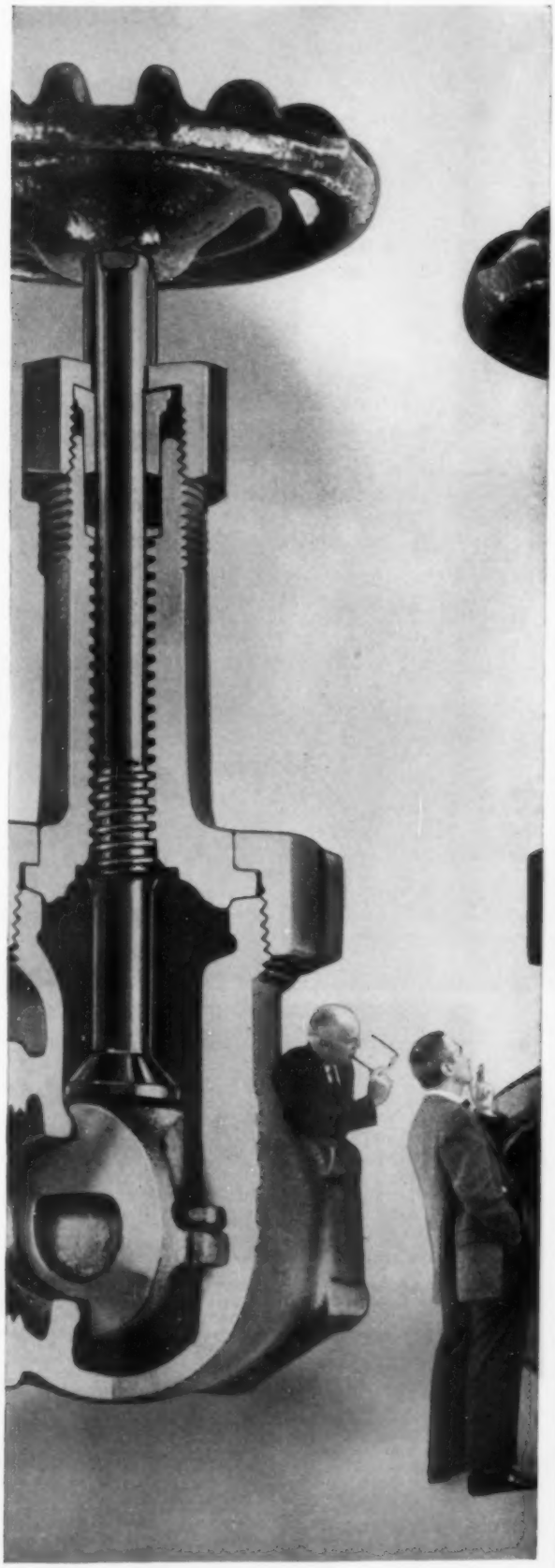
4385

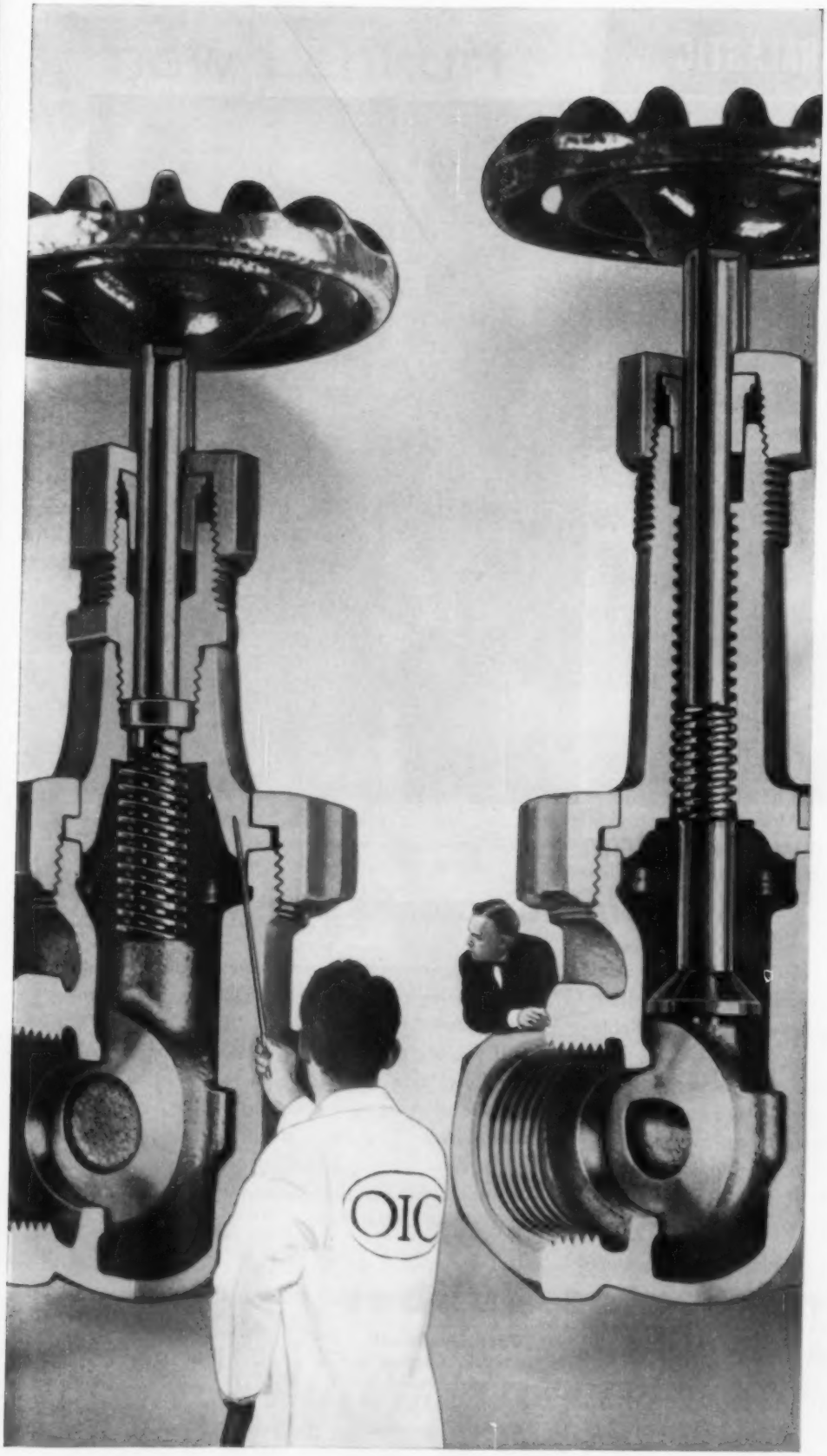
Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

-three gate
valve types
in three
pressure classes-

all with safe efficient
union bonnet joints

OIC VALVES
BRONZE, IRON, FORGED AND
CAST STEEL LUBRICATED PLUG VALVES



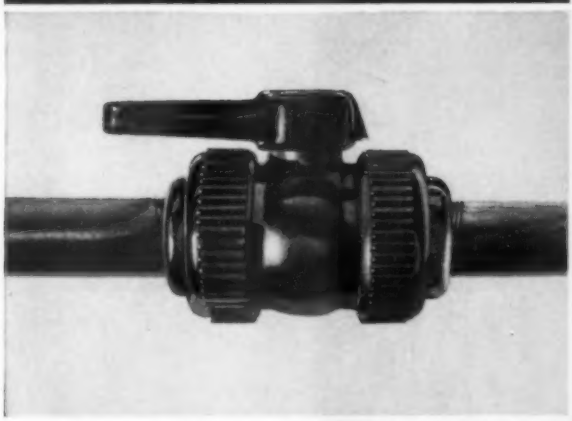


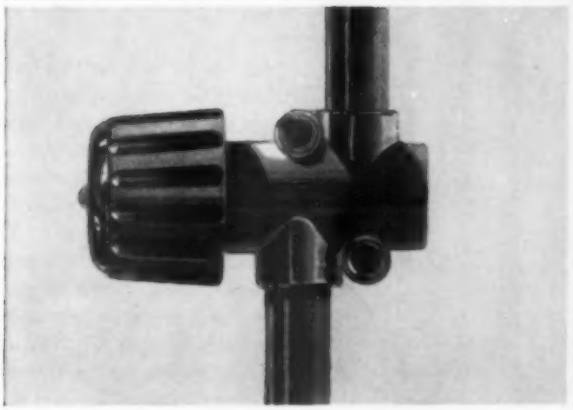
No matter how far you look, this is the most complete *modern* line of bronze gate valves you'll find anywhere. All, of course, feature OIC *alloy-40* stems which ordinarily last for the life of the valve.

125-lb., 150-lb., 200-lb. pressure classes. Solid or split wedges, rising or non-rising stems. Call your OIC Distributor for quick service. Or write for specification literature.

THE OHIO
INJECTOR COMPANY
Wadsworth, Ohio

Naugatuck KRALASTIC





Now complete your system with corrosion-proof Kralastic Valves!

Kralastic®, the tough, chemical-resistant rubber resin material that has been adopted by pipe makers from coast to coast, used the world over, is now available in valves, too.

Now you can enjoy all the superior properties of Kralastic in globe valves, needle valves, ball valves, a wide variety of the most common types...in sizes from ⅛" to 3"...with still other sizes soon to come.

Lightweight, rustproof, rotproof, non-scaling, non-galling, impact-resistant, smooth-walled, self-lubricating, non-contaminating valves of Kralastic withstand working pressures as high as 180 psi, temperatures up to 140°F, as low as—20°F.

If you are presently using Kralastic pipe for only part of your system, now's the time to complete it with Kralastic. If you've been waiting until valves of this material became available, don't waste another day.

For more information on valves of Kralastic, write Chemtrol, Lynwood, Calif., Sloane Mfg. Co., Sun Valley, Calif., or the address below.

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new Lenkurt **microtel** Type 74A planned for your growth!

Basic terminal of Lenkurt *Microtel* consisting of a transmitter, receiver and power supplies.

Power supply for the transmitting and receiving klystrons. The only active components in this supply are three voltage regulator tubes.

This new Lenkurt Type 74A system answers all point-to-point communications requirements. Operating in the high-frequency industrial band (Operational Fixed) from 6575 to 6875 megacycles, it is clean in design, reliable and highly flexible. With Lenkurt 45BX Carrier, a single terminal can accommodate from 4 to 240 channels, *over the one antenna system!*

Look at these important features:

- **Easy to install**—Standard 19-inch rack mounting; compact plug-in construction.
- **Easy to maintain**—Miniaturized plug-in components similar to Lenkurt 45-class equipment; all components accessible from front; built-in test facilities.
- **Less power consumption**—Fewer tubes; operates from standard battery supplies or from 115-volt a.c. mains.
- **Stand-by flexibility**—Frequency diversity or space diversity; combining or transfer facilities.
- **Economical expansion**—With r-f circulators 2, 3 or 4 terminals can be added to same antenna system.
- **Automatic switching**—Permits unattended operation; back-to-back terminal equipment permits dropping and reinserting of channel groups at repeater points.
- **System length**—Up to 300 miles with medium loading and multiple repeater points or considerably farther depending on specific requirements.

Automatic Electric Sales Corporation
Northlake, Illinois

Please send booklet describing new Lenkurt Microtel Radio System.

Name..... Title.....

Company.....

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AUTOMATIC ELECTRIC

Subsidiary of **GENERAL TELEPHONE**

BUTAMER*

The most practical method for producing alkylate: Butamer and HF Alkylation in combination as a single unit

Increasing use of alkylate for blending into motor fuels makes these two up-to-the-minute processes highly important to petroleum refiners. Butamer is a new process for producing isobutane . . . "HF" Alkylation is an efficient, economical process which combines isobutane with olefins to produce alkylate, much in demand today as a motor fuel component.

With the advent of high compression ratio engines, usually starting at 9.5:1, motor fuel, especially those deficient in isoparaffins, have been associated with an unusual engine noise called "rumble." Further study reveals this rumble can be eliminated through the use of a better balanced fuel, namely using a fuel composed of a greater volume percentage of isoparaffins. Alkylation produces a high octane isoparaffin that also has good sensitivity, ignition point and combustion characteristics.

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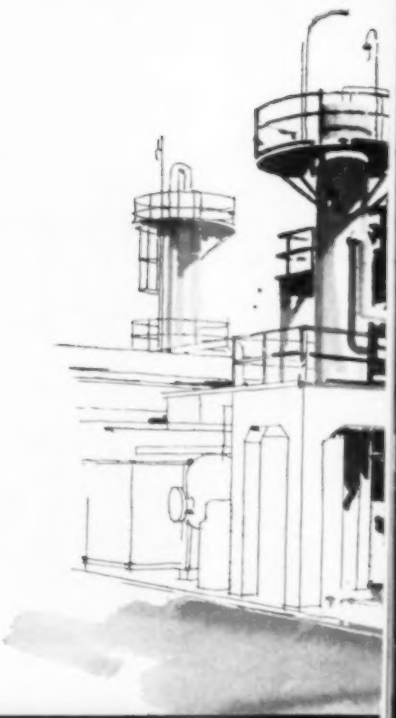
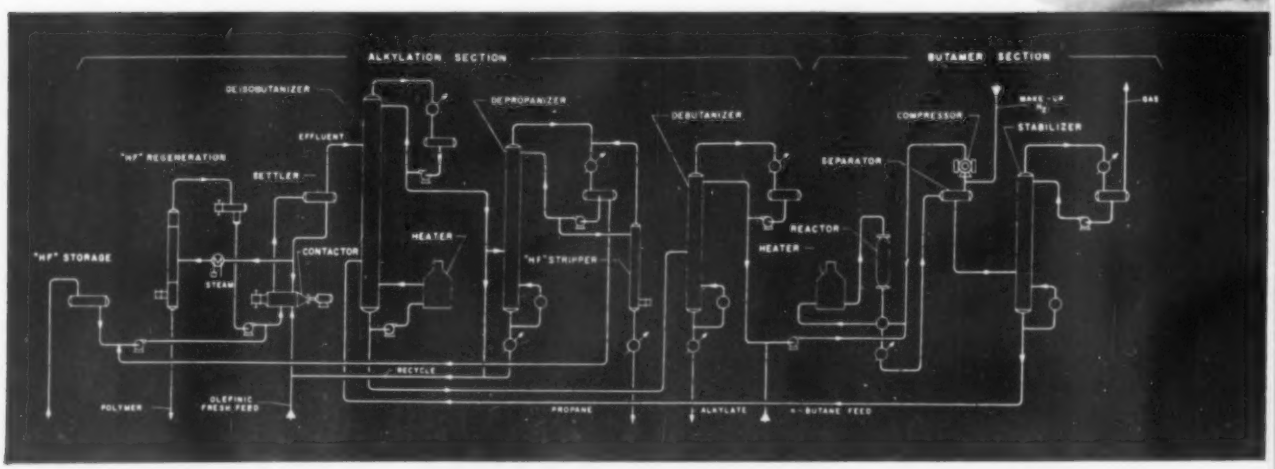




More Than Forty Years Of Leadership In Petroleum Refining Technology

HF Alkylation

Butamer—Heart of this process is a noncorrosive, stable and rugged platinum-containing catalyst especially developed by UOP. Capable of operating at relatively low temperatures, its use assures a sufficiently high concentration of isobutane in the reactor effluent to eliminate excessive recycle of normal butane.

Operating under hydrogen pressure, with low hydrogen-to-charge ratio, the high catalyst activity results in economical liquid hourly space velocities, thus requiring only a modest catalyst inventory. The mild operating conditions further assure minimum loss to by-products.

HF Alkylation—"HF" Alkylation is a catalytic process which combines olefins such as propylene, butylenes, and amylenes with isoparaffins (usually isobutane) to form a mixture of branched chain hydrocarbons of higher molecular weight known as alkylate for aviation and motor fuel.

These two processes are readily and economically integrated. Together, they form the ideal, most practical method for producing alkylate.

Write for detailed information. Ask also about other UOP refining and petrochemical processes, available to refiners everywhere, for improving operating efficiency and producing better and more profitable petroleum products.

UOP®

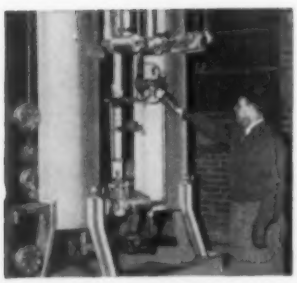
UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U.S.A.

Some of the many available desiccants

It takes an expert prescription to dry gas properly . . .

Come to Kemp



Kemp Model 300 S Dryer protects pneumatically operated instruments at Sun Oil's Marcus Hook Plant. This unit has operated continuously since installation with little or no attention, giving specified performance at all times.

Over 20 *different* desiccants . . . each with its own particular properties and uses. It takes experience to choose the right one and engineer it into a drying system that will exactly meet your needs.

Kemp offers you that experience . . . almost a quarter-century in designing and building drying apparatus. Kemp engineers combine the right equipment and the right desiccant into a unit that brings you dependability, ease of maintenance, and simplicity of operation. For any use . . . guarding pneumatically operated instruments and tools . . . drying process gasses and inerts for blanketing and purging . . . pressurizing anhydrous liquids . . . liquid drying or any of a host of other applications . . . a Kemp Oriad or Convection type dryer will give you high efficiency drying at low cost.

To improve performance and cut costs in your operation, have Kemp engineers recommend a system for your plant. Your Kemp Representative will give you detailed information, or write direct for Bulletin D-100. The C. M. Kemp Mfg. Co., 405 East Oliver St., Baltimore 2, Md.

Kemp Convection Dryers

Kemp Inert Gas Generators

KEMP
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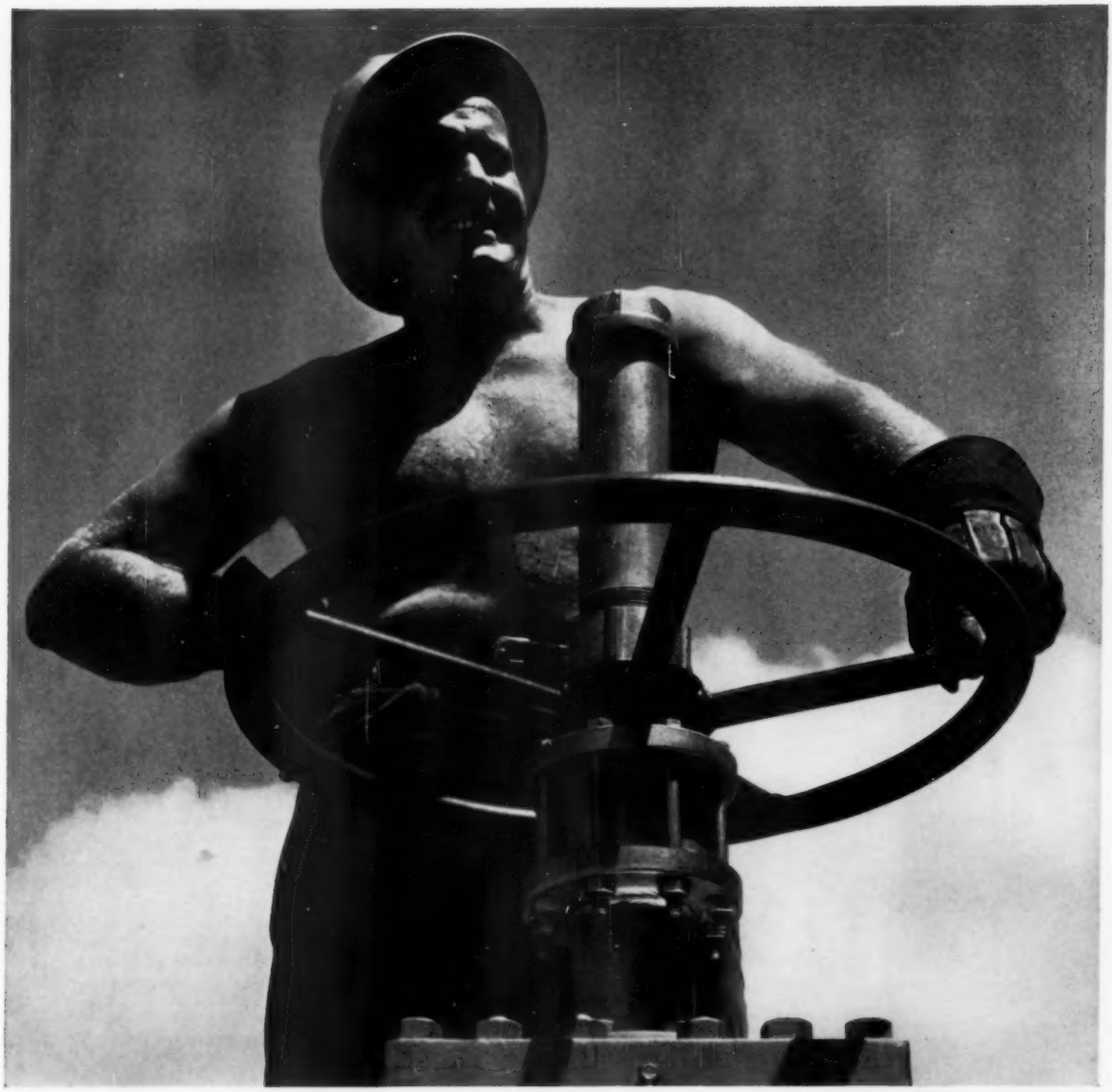
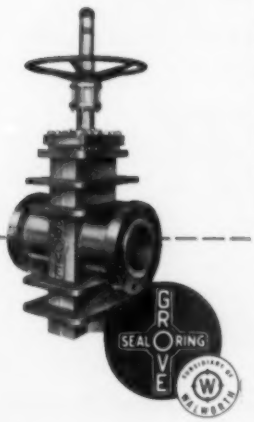
Kemp Industrial Carburetors

Kemp Oriad Dryers



You're never stuck with a **GROVE VALVE**



Here's the valve you set and forget. Grove's exclusive Seal-O-Rings wipe out the need for valve lubrication. You're never stuck with valve failure because of forgotten lubricant or depleted sealing compound. The load of lubrication is gone forever. Specify Grove Seal-O-Ring Gate Valves. Under pressure the tightest seal in the line.

Grove valves never require lubrication

GROVE VALVE & REGULATOR COMPANY

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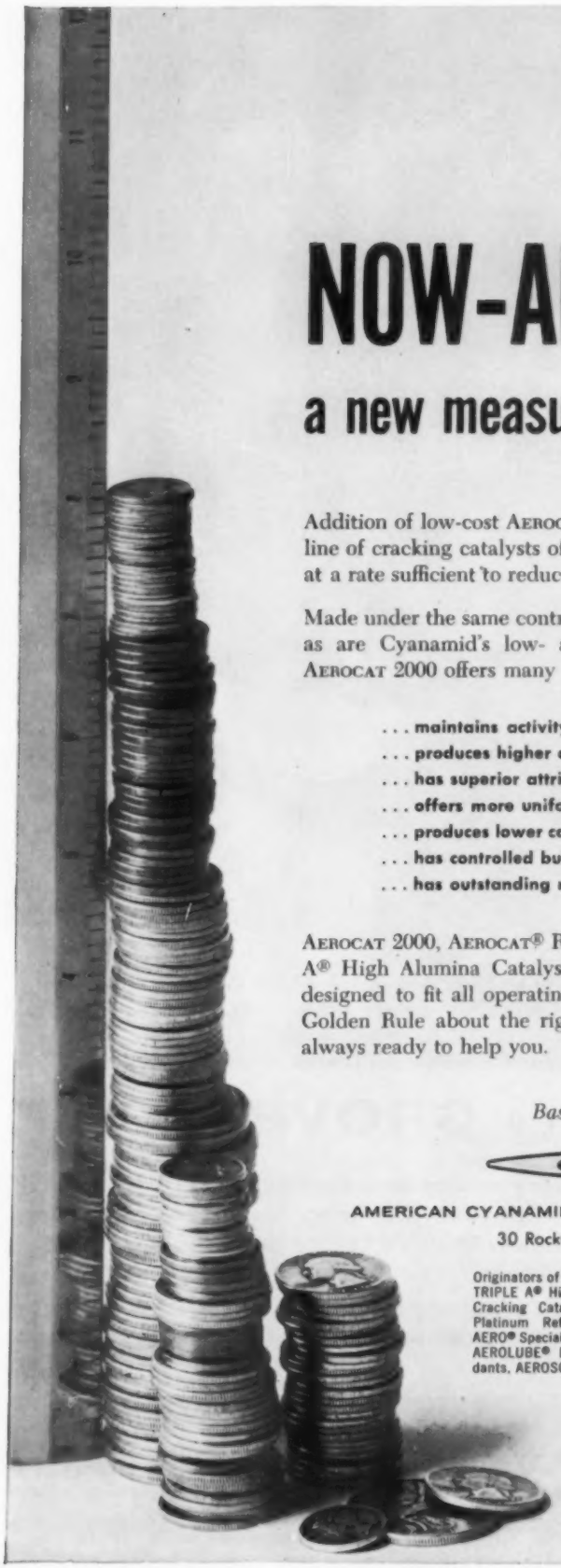


NOW-AEROCAT® 2000

a new measure of catalyst economy

Addition of low-cost AEROCAT® 2000 Fluid Cracking Catalyst to Cyanamid's line of cracking catalysts offers refiners new economy where catalyst is used at a rate sufficient to reduce the effect of heavy metals.

Made under the same controlled conditions, by the same advanced processes as are Cyanamid's low- and high-alumina synthetic cracking catalysts, AEROCAT 2000 offers many advantages over other low-cost catalysts:

- . . . **maintains activity stability with greater economy**
- . . . **produces higher octanes**
- . . . **has superior attrition resistance**
- . . . **offers more uniform physical and catalytic properties**
- . . . **produces lower coke**
- . . . **has controlled bulk density for better fluidization**
- . . . **has outstanding regeneration properties**

AEROCAT 2000, AEROCAT® Regular Fluid Cracking Catalyst, AEROCAT TRIPLE A® High Alumina Catalyst – a complete line of high efficiency products designed to fit all operating conditions. Talk to Cyanamid's Man with the Golden Rule about the right AEROCAT Catalyst for *your* operation. He is always ready to help you.

Basic in Catalyst Chemistry

CYANAMID

AMERICAN CYANAMID COMPANY • REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N. Y.

Originators of AEROCAT® Fluid Cracking Catalysts, AEROCAT TRIPLE A® High Alumina Catalysts, AEROCAT® 2000 Fluid Cracking Catalyst, AEROFORM® Fluid Hydroforming and Platinum Reforming Catalysts, AERO® HDS Catalysts, AERO® Specialty Catalysts, CYPAN® Drilling Mud Conditioner, AEROLUBE® Lubricating Oil Additives, AERONOX® Antioxidants, AEROSOL® Surface Active Agents.

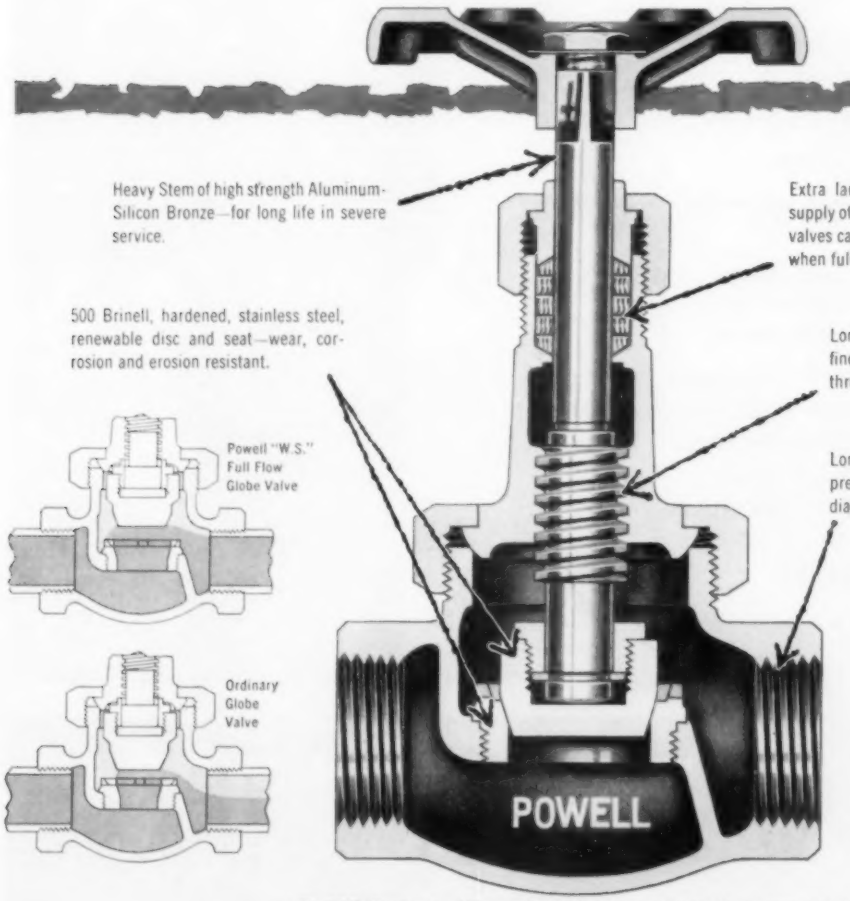
BULLETIN!

POWELL introduces new member in world's largest family of valves

Powell engineered "Full Flow" bronze valves are now available in a full line: the brand-new 150-pound screwed end Globe Valve, in addition to the well-known 200-300 pound Screwed and the 150-300 pound Flanged Globe and Angle Valves.

Although designed by Powell to assure maximum flow with minimum pressure drop and internal turbulence, these valves can be throttled to permit only the minutest amount of fluid to pass through. And, if desired, they can be supplied with Indicator Collar, Arm and V-port Disc for quickly determining flow and holding it constant.

Compare these advantages of Powell Full Flow valves:


Heavy Stem of high strength Aluminum-Silicon Bronze—for long life in severe service.
Extra large stuffing box holds ample supply of lubricated asbestos packing—valves can be repacked under pressure when fully open.
500 Brinell, hardened, stainless steel, renewable disc and seat—wear, corrosion and erosion resistant.
Long Acme Stem Threads have a fine pitch to easily regulate the close throttling and reduce thread wear.
Long pipe thread and thread run-off prevent jamming the pipe against the diaphragm and distorting the seat.
Powell "W.S." Full Flow Globe Valve
Ordinary Globe Valve
POWELL

When you require precise flow control with minimum pressure drop and turbulence, little maintenance and long life, specify Powell Full Flow Valves. Consult your local distributor, or write us for illustrated literature.

Fig. 2600 (Sectional)—150-pound "W.S." Full Flow Globe Valve, Screwed Ends

THE WM. POWELL COMPANY • *Dependable Valves Since 1846* • **Cincinnati 22, Ohio**

HAMMOND IRON WORKS

announces

THE HAMONDFLOTE* plastic COVER

HAMONDFLOTE COVER

the first practical and guaranteed

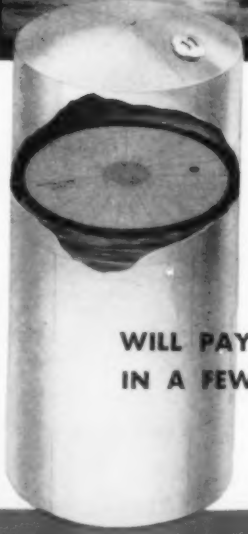
FLOATING ROOF

FOR small diameter tanks in MARKETING, BULK STORAGE, PRODUCING and REFINING OPERATIONS.

Suitable for storing gasolines, crude oils, and hydrocarbon chemicals.

The HAMONDFLOTE COVER is constructed of rigid polyisocynate foam—a plastic material with exceptionally low density and high load carrying capacity.

- **CONSERVES VAPOR • PRESERVES PRODUCT**
- **PREVENTS CORROSION • LOW COST—NO MAINTENANCE**
- **UNSINKABLE • VIRTUALLY INDESTRUCTIBLE**
- **LONG LIFE**—(more than 10 years expectancy)
- **UNAFFECTED BY WORKING TEMPERATURES** —(from —94° to +300° F)
- **EASILY INSTALLED OR REMOVED**



WILL PAY FOR ITSELF IN A FEW MONTHS.

Write or call us and we will send our nearest representative to give you full information.

*Pat. Pending, Trade Mark reg.

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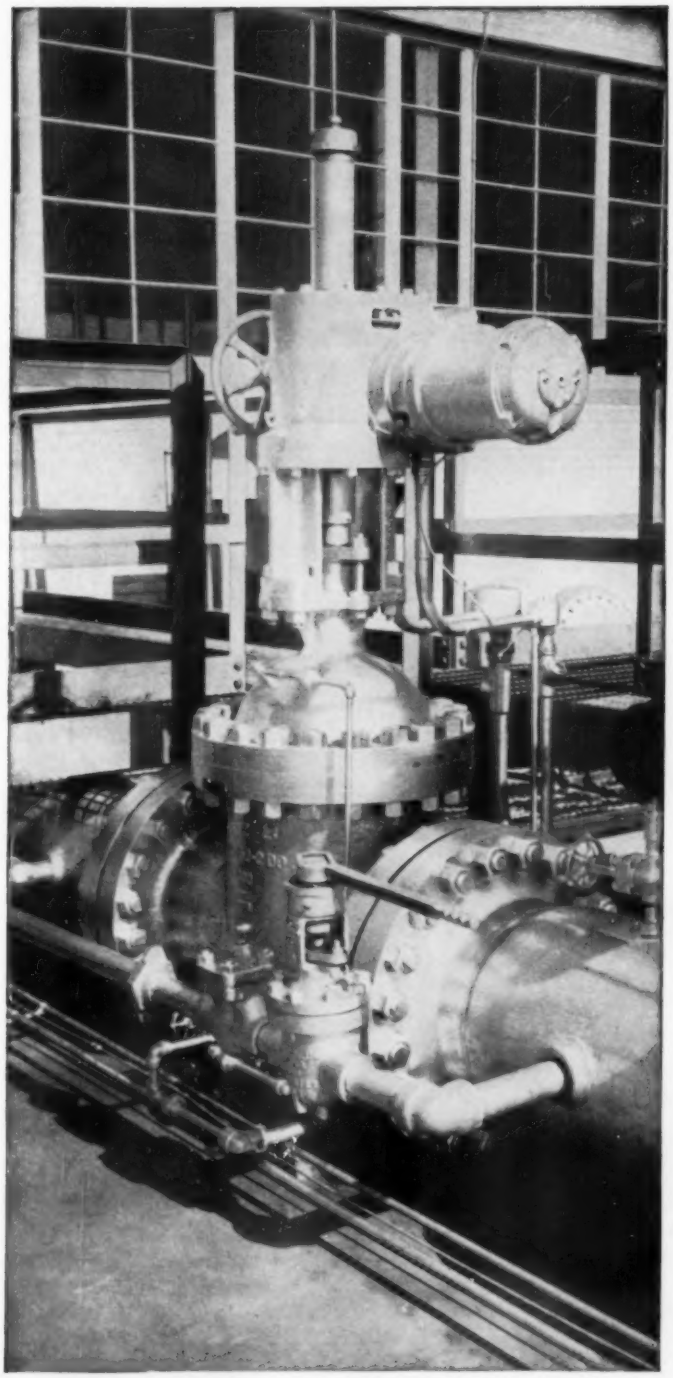
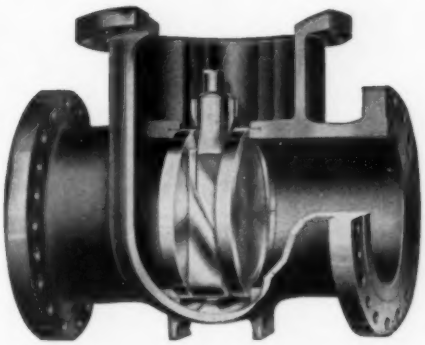


DARLING

fully-revolving double disc
pipe line gate valve



IDEAL FOR EFFICIENT CONTROL

Here's why

Operation is *consistently* trouble-free! Minimum friction, easy opening and closing, with self adjustment for positive closure. Wedging principle automatically compensates for any body deflection. Fully revolving discs avoid wear concentration. Discs and seats wipe clean with each operating cycle. In short . . . prolonged high efficiency with an extreme minimum of attention. It will pay you to give us an idea of your service needs and get specific details.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Penna.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

DARLING
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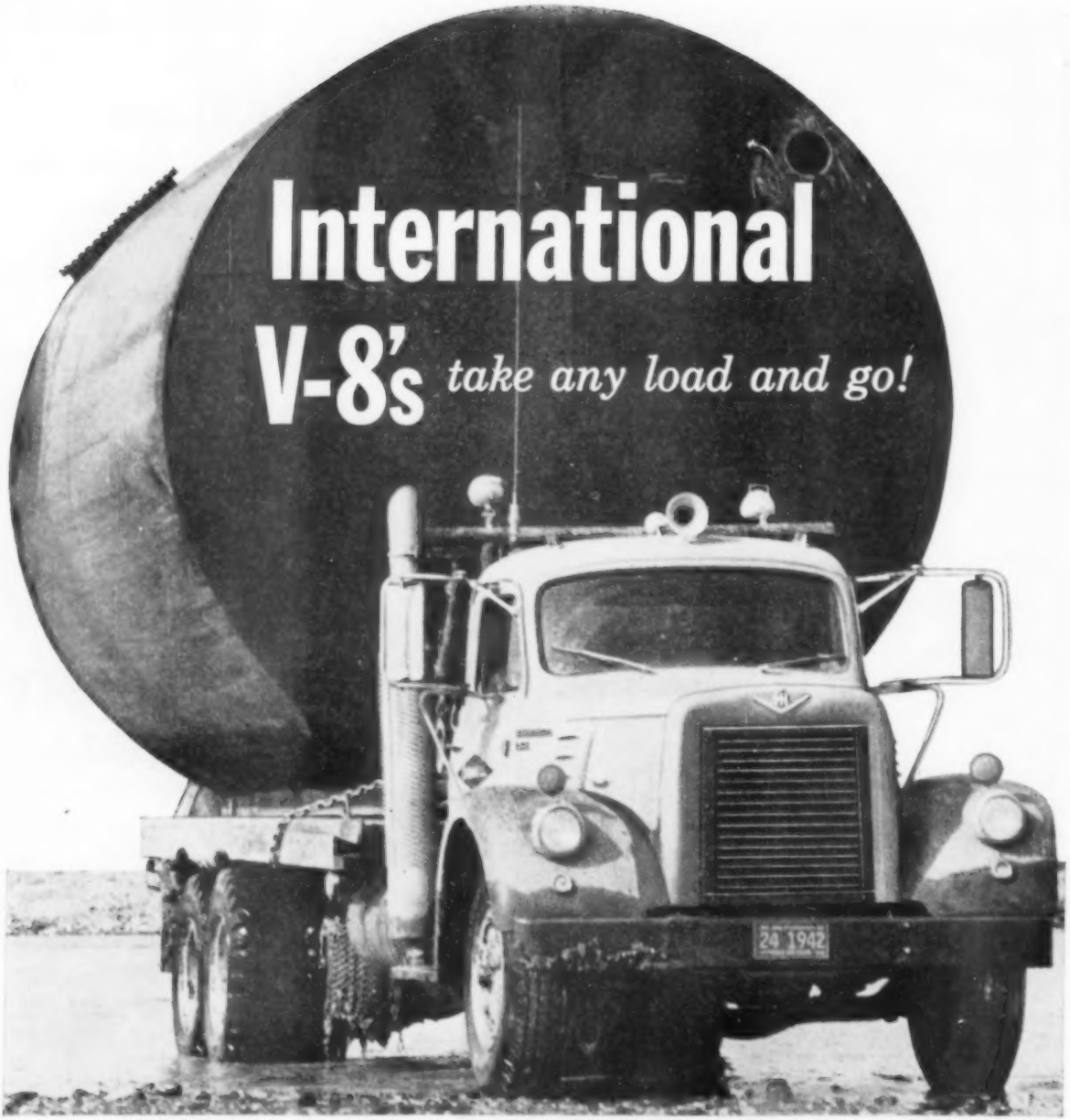
VALVES

International V-8's *take any load and go!*



Model VF-210 INTERNATIONAL Truck. This V-8 powered six-wheeler is one of a complete line of conventional or COE models rated to 65,000 lbs. GCW.

From all-steel reinforced cabs to extra-husky frames, INTERNATIONAL tandem axle V-8 trucks are quality built by truck specialists.

Rugged V-8 engines with up to 549 cu. in. displacement are power-matched to drive lines to get going *and keep going* . . . whether you're working the pumps or rolling down the highway.

All-truck engineering cuts oil requirement with special pistons and rings. Metered-flow engine water jacket design evens engine temperatures. Finish-honed replaceable exhaust valve guides and self-aligning tappets mean reduced downtime.

The result: INTERNATIONAL Trucks cost *least* to own!*

**Signed statements in our files, from fleet owners throughout the U. S., back up this statement.*

International Harvester Company, Chicago
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors

INTERNATIONAL TRUCKS cost least to own!

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

If you're considering deeper or higher pressure wells—

TIMKEN® SEAMLESS STEEL TUBING GIVES YOU INTERNAL PRESSURE STRENGTH TO 15,000 PSI— YIELD STRENGTH TO 125,000 PSI

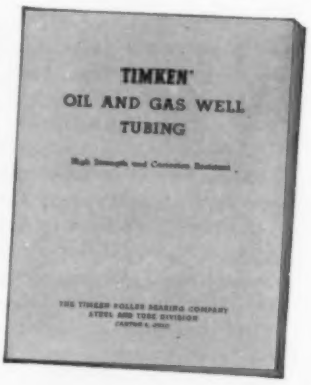
THE WELL HASN'T YET BEEN DRILLED that can apply the pressure Timken® oil and gas well steel tubing can take. To meet the trend to deeper wells and higher pressures, here's tubing that can take internal pressures up to 15,000 psi.

And Timken seamless steel tubing goes beyond the stiffest specifications of the American Petroleum Institute. The highest API specification—5A—calls for a yield strength of 105,000 psi. We offer you up to 125,000 psi yield strength, with maximum uniformity of properties and quality.

Timken seamless steel tubing is available in a variety of sizes and analyses. Some are specially selected for corrosion resistance. All provide high ductility.

Into every foot of Timken seamless steel tubing goes 24 years of experience in pioneering high pressure seamless steel tubing applications for the petroleum and other industries. Several extremely deep oil and gas wells are now using Timken seamless tubing with very satisfactory results.

FREE ENGINEERING STUDY
A recent study by Timken Company metallurgists reviews the properties of various alloys and their application to oil field operation. Get your free copy today of "Timken Oil and Gas Well Tubing". Write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".



TIMKEN *Fine Alloy* STEEL

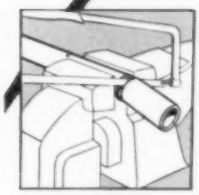
TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

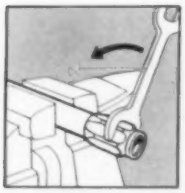
Make up hose lines in the field... *FAST*...

with STRATOFLEX

BULK HOSE • REUSABLE FITTINGS



1. Cut hose to desired length



2. Screw on socket counterclockwise

3. Oil inside of hose and insert assembly tool

4. Screw swivel nipple or male fitting into socket and remove tool

When hose lines have to be replaced on a drilling rig, it can result in costly downtime. You can save time and cut costs by making up your own hose assemblies in the field with Stratoflex bulk hose and reusable fittings. Just cut the hose to proper length and attach the fitting. The hose assembly is finished and equipment is back at work in minutes.

Stratoflex designs hose lines to conduct oils, gas, gasoline, diesel fuel, anti-freeze, water and air. Assemblies especially suited for offshore use feature stainless steel braid hose and brass or protected plate steel fittings.

Save time and money by making up your own hose lines with Stratoflex bulk hose and reusable fittings . . . available from any Mid-Continent Supply field store.

SF 10-8

MID-CONTINENT SUPPLY CO.

MID-CONTINENT BUILDING • FORT WORTH, TEXAS

Expert Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

From London, England to Curacao

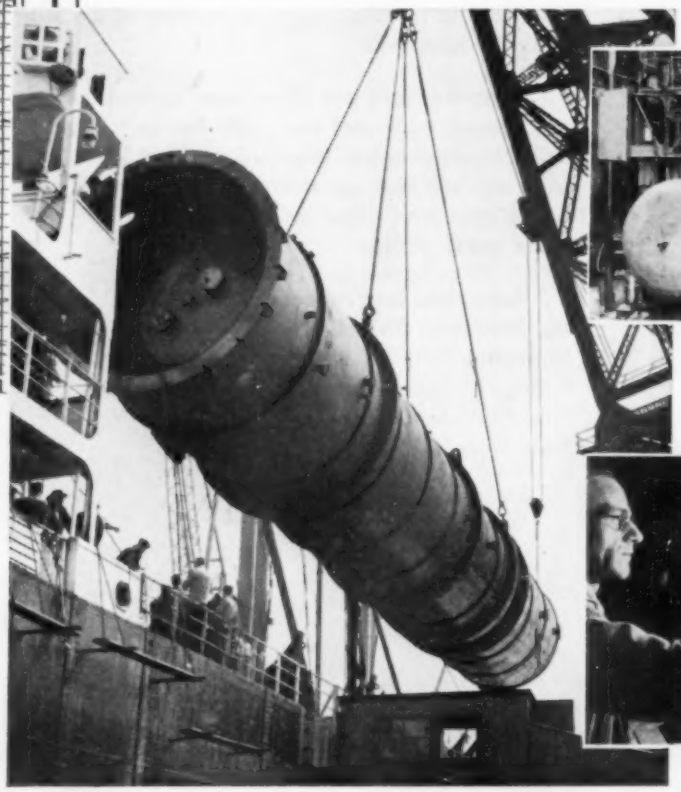
Harvey's service to the world's petroleum industry is strikingly shown in this view of a giant fractionating column being loaded for shipment. Measuring 142 ft. by 21 ft. 6 in. o/a diameter, and constructed of stainless clad M.S. plate, it was fabricated throughout by Harveys for the N.V. Curacaosche Petroleum Industrie Mij., refinery expansion programme at Curacao.

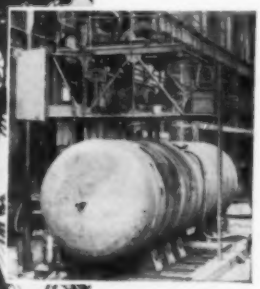
NOTE THESE POINTS—

Harveys are able to handle fabrications up to 120 tons in one piece.

A high percentage of the fabrication is carried out by automatic welding.

Stationary and mobile X-ray units are supplemented by the use of Gamma and Ultrasonic equipment for non-destructive inspection and testing.





Fully mechanised arc-welding equipment.

Viewing an X-ray film for quality control.

Work fabricated in:

MILD STEEL

HIGH TENSILE LOW-ALLOY STEELS

STAINLESS STEELS

NICKEL AND HIGH NICKEL ALLOYS

CLAD STEELS ETC.

Vessels to Lloyds Class I, B.S.S. and A.S.M.E. Codes.

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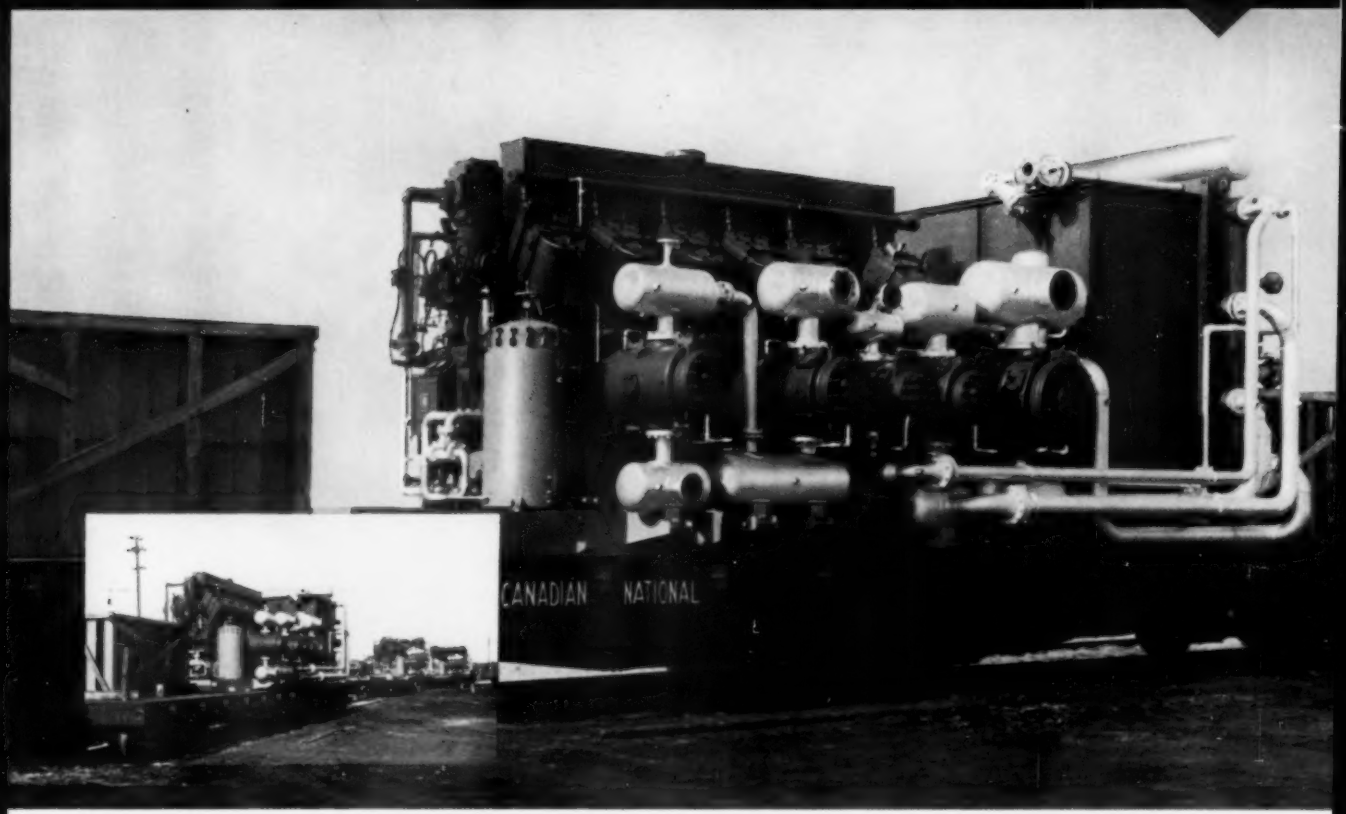
WOOLWICH ROAD, LONDON, S.E.7. ENGLAND.
Cables: 'Cheaper, London.'

SPECIALISTS IN THE PRODUCTION OF HEAVY WELDED FABRICATIONS FOR THE PETROLEUM INDUSTRY.

BEAIRD-INGERSOLL-RAND Packaged Compressor Plant

Lowest Cost Per Horsepower Installed



CANADIAN BUILT Beaird-Ingersoll-Rand, 660 h.p. 12SVG packaged compressor units have Young radiators with up-draft air discharge. Interstage gas, engine water and lubricating oil cooling sections are built into the radiator. Other sizes from 120 to 660 h.p.

Beaird Packaged Compressors—

MADE IN CANADA

BEAIRD
another AMF product
PACKAGED COMPRESSOR PLANTS

Packaged Compressors are just one of the many products manufactured by Beaird for the petroleum and petrochemical industries. When you are in the market for new equipment or assistance in developing a specialized product . . . contact Beaird for a qualified appraisal or quotation.

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These three 660 h.p. Beaird-Ingersoll-Rand packaged compressor plants are among the first 18 Canadian-built units to be delivered by Beaird International, Inc., Calgary. This new Beaird subsidiary offers Canadian producers complete sales, service and available manufacturing facilities.

Designed for a major oil company, the units will serve a dual role in gas processing and boosting. Three stages will be used for gas boosting and two stages will handle propane for the chilling process. Another example of the flexibility possible in solving gas production problems, these compressors reflect Beaird's years of design and field experience.

With Canadian facilities, Beaird International offers a single source of responsibility from initial quotation to field service. Beaird offices in Caracas, Venezuela serve South American markets.

Wherever oil or gas is produced, there are skilled Beaird gas engineers to assist in finding an economical solution to your special operating requirements.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
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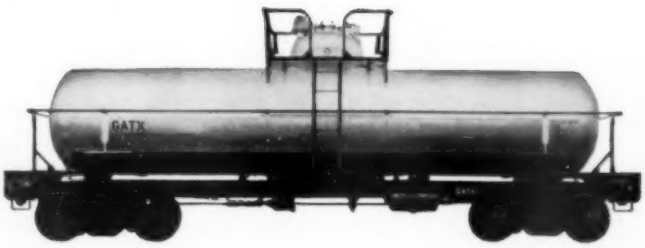
museum pieces are for museums

In 1869, this locomotive was the last word. Today, it is a museum piece.

Not so, your product. If it were, you'd be in the museum business or out of business entirely.

But, if you ship a liquid in bulk, what about the package—the car in which your product goes to market?



Packages are for selling—whether they are on a shelf or on a railway siding. Your product deserves the best package you can find for it.

If your product is a liquid shipped in bulk, GATX builds or can build just the package for it—a tank car that protects your shipment and promotes your good name.

GATX operates the cars for you, knows where they are, keeps them on the move and maintains a nationwide network of shops for their service and upkeep.

No capital investment . . . no operating worries . . . when you ship GATX!

GATX GENERAL AMERICAN

GENERAL AMERICAN TRANSPORTATION CORPORATION

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Largest New Cooling Tower Installation Is Fungus-Proof

The recent installation of 40 fan cells of Marley Double-Flow cooling towers at one location is outstanding in capacity and in pre-determined durability, too, because every foot of the 1,715,000 board feet of lumber used was **MARLITH** pressure protected after fabrication.

This huge installation highlights industry's growing concern over the greatest hazard to cooling tower service — **FUNGAL DECAY. MARLITH** treatment is a most positive and economical step to prevent the destructive action of fungi — a hazard the country and the world over. The efficacy of **MARLITH** treatment has been proved conclusively in hundreds of laboratory and field tests in many parts of the world.

There can be no question that the accumulated costs of maintenance and down time for an unprotected cooling tower will, over the years, far exceed those of a MARLITH-treated tower. Most important, **MARLITH** treatment assures for the future an adequate supply of cold water at an efficient operating temperature — a factor virtually as important as your basic materials supply.

If water conservation is in your development plans (it's good business for you, your neighbor, your country), you'll find it profitable to get full information from your Marley engineer on **MARLITH** — the "life insurance" for your cooling towers. Just ask him or write for Marlith Bulletin M-58.

MARLITH is a registered trade name of the

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MARLEY

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DRESSER-IDECO COMPANY, Columbus, Ohio, — Radio, radar, TV and microwave towers, steel buildings, aircraft hangars, mechanical parking garages, electric power substations.

DRESSER MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION, Bradford, Pa. — Pipe line couplings, pipe repair sleeves and clamps, weldments, high alloy rings, welding fittings.

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THE GUIBERSON CORPORATION, Dallas, Tex. — Swabs, packers, anchors, workover equipment — drilling heads, blowout preventers, tubing blocks, hooks, swivels, kellys, savers, unions. Gas lift equipment. Molded rubber products.

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IDECO, INC., Dallas, Tex.—Hydrair* and Power Rigs; Full-View* Masts; substructures; single, dual and Drive-In Rambler Rigs; blocks, swivels, rotaries; mud pumps; petroleum equipment and supplies.

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LANE-WELLS COMPANY, Houston, Tex.—Electric, nuclear and temperature well logging, Vibro-Frac*, Koneshot* perforating, bullet perforating, packers, bridging plugs.

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MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar* and Magcogel* drilling muds and other specialized oil well drilling fluids and chemicals.

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ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind. — Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, and positive displacement meters.

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SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif. — Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Red rubber stabilizers.

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SOUTHWESTERN INDUSTRIAL ELECTRONICS CO., Houston, Tex.—Seismograph systems and instruments — electronic, electro-mechanical. Computers — analog and digital; recording systems. Special transformers, reactors.

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WELL SURVEYS, INC., Tulsa, Okla. —Nuclear and electronic research and development for the petroleum and other industries. Originators of radioactivity logging.

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Hermetic Seal Transformer Co.®

HERMETIC SEAL TRANSFORMER CO., Garland, Tex.—Custom design and manufacture of transformers, reactors, magnetic amplifiers, filters and associated components.

PACIFIC®

PACIFIC PUMPS, INC., Huntington Park, Calif. — Centrifugal refinery pumps; pumps for petrochemical, chemical, electric power generating stations; marine steam turbopumps; oil well plunger pumps.

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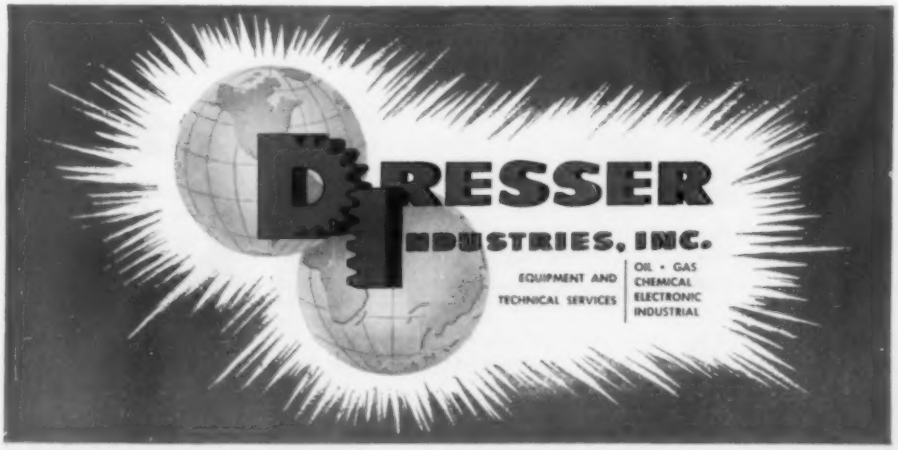
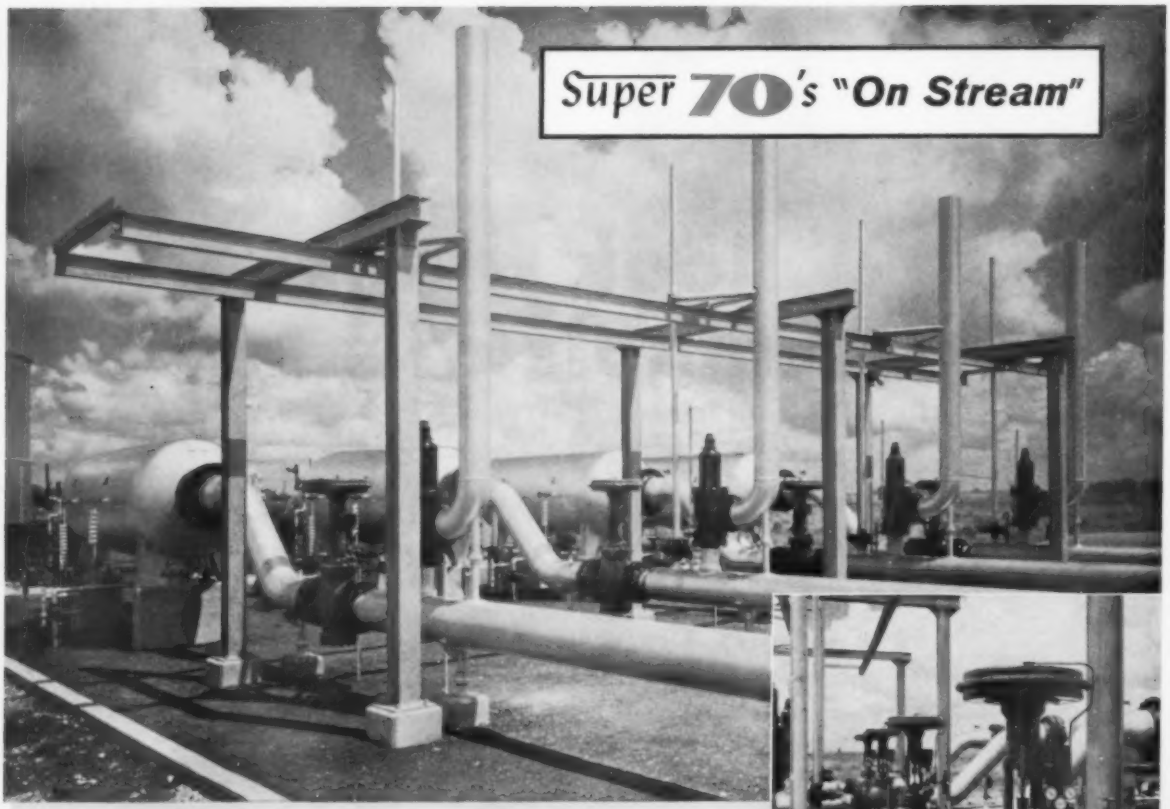
Tomorrow's Progress Planned Today by Dresser Men with Imagination!



REPUBLIC NATIONAL BANK BUILDING • POST OFFICE BOX 718 • DALLAS 21, TEXAS



"Life-Blood" of a Large Refinery!

This natural gas metering station feeds 100 MMSCF of gas per day to a large Gulf Coast Refinery. If it were necessary to shut down the station for repairs, operation of the refinery would be seriously impaired.

That's why engineers who designed the station wanted to be absolutely sure the control valves would function properly day in and day out under all operating conditions.

Because of their superior performance characteristics and rugged dependability . . . and because of BS&B's reputation for quality products and dependable service in the oil industry . . . BS&B Super 70 Control Valves were selected. Now "on stream", they are performing well in every respect.

BS&B Super 70 Valves are available in a complete range of sizes . . . with either clamp ring—float ring, or flanged—gasketed body closures. Specify them on your next job!

BS&B Super 70 Diaphragm Control Valves with Clamp Ring—Float Ring Body Closure.

BLACK, SIVALLS & BRYSON, INC.

Controls Division,
Dept. 4-A10
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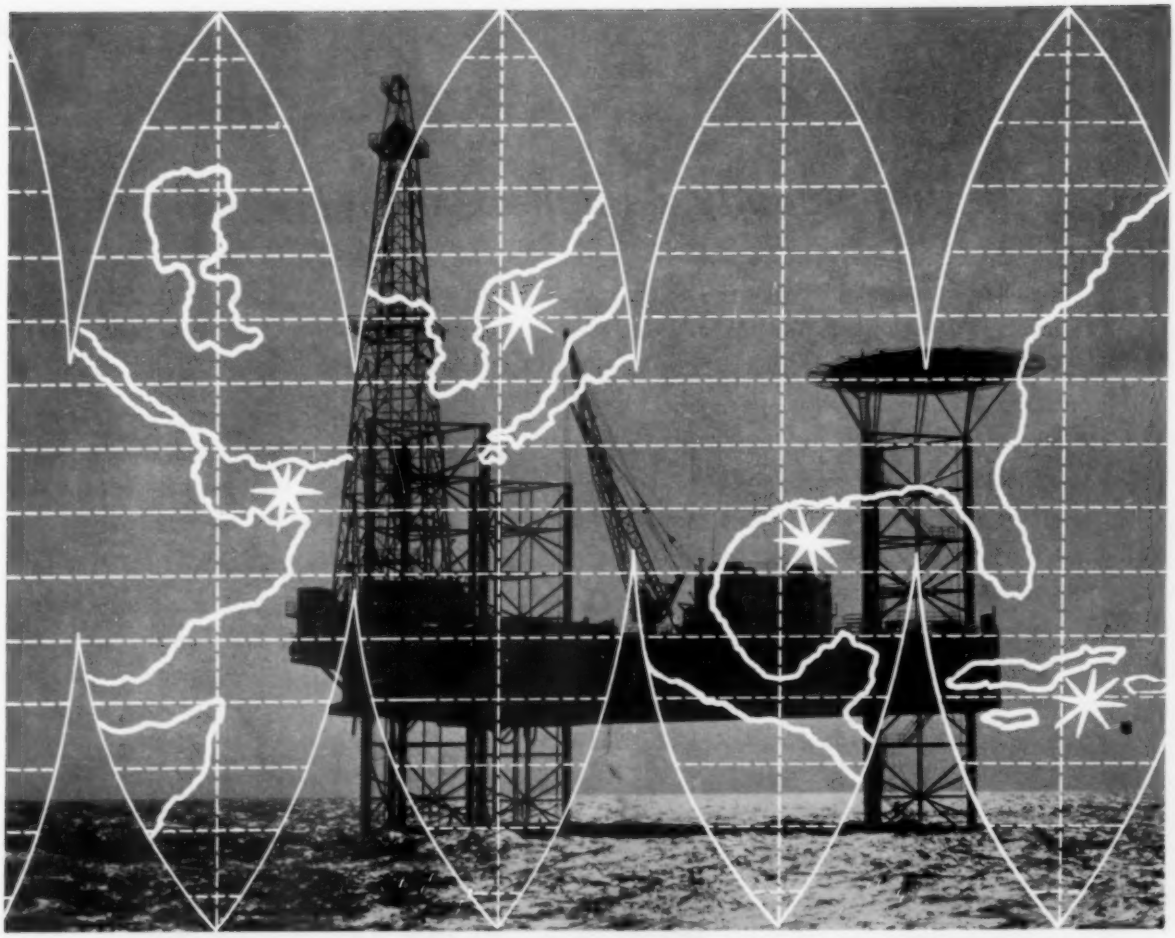
Kansas City 26, Missouri

SUPER BS&B 70



LeTOURNEAU PLATFORMS

now operating in waters all over the world!

As the search for offshore oil spreads to remote corners of the world, LeTourneau mobile drilling platforms are operating under varied and challenging conditions. LeTourneau platforms are now drilling in the Gulf of Mexico . . . the Caribbean Sea . . . the Persian Gulf and soon the Sea of Japan.

While each platform utilizes the same basic design components, each is custom-engineered to meet the specific requirements of the operating company. LeTourneau engineers thus offer you a rich background of knowledge and experience in the construction of mobile offshore platforms . . . both self-contained and tender-assisted.

In addition to the many inherent advantages of the basic platforms, LeTourneau offers technical assistance from initial planning to moving on to location.

If your company is thinking in terms of a mobile offshore platform . . . we, at LeTourneau, would enjoy the opportunity of discussing the matter with you. No obligation, of course. *Write for our new brochure "Oceans of Experience."*

LET
LeTOURNEAU EQUIPMENT

R.G. LeTOURNEAU INC

MARINE PRODUCTS DIVISION,

28610 South MacArthur, Longview, Texas

M-114

AUTOMATIC LEASE CONTROL

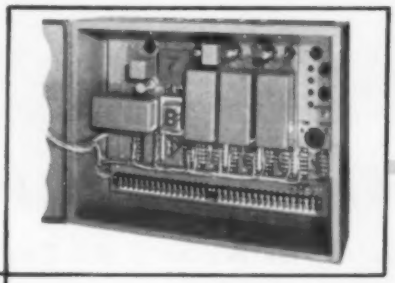
Individually designed and engineered!

The line illustration on the right represents a typical automatic well test system. The "Cyclotest" Automatic Well Test Control Panel, pictured below this illustration, is connected to three-way solenoid actuated diverting valves installed in each flow line production manifold. A valve, when actuated, diverts the flow of oil through the well test equipment, comprised of a test separator or heater-treater and meters for oil, water and gas. Each meter actuates a momentary contact for each unit of production. This test information, in the form of electrical pulses, can be recorded by various pens in an associated strip chart operation recorder or in digital form by the CSC "Cycloprint" DATA Printer, shown below the illustration on the right. Also recorded are well identification numbers and duration of tests.

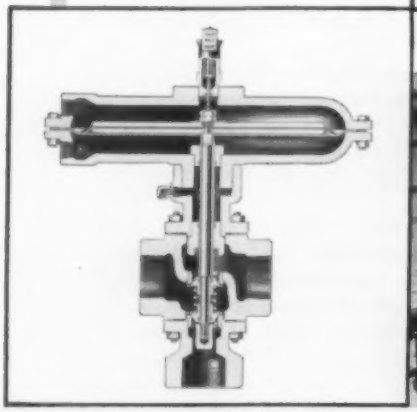
If Fisher Type 1620 three-way, 3 position valves are used in the production manifold, the "Cyclotest" panel can be provided with clocks for well flow control for automatic stop-cocking of wells.

High Level Safety Float Switches, Fisher Type 2800-252V, are installed in both test and production separators. High level in Test Separator carries oil to be diverted back through Production Separator; high level in Production Separator can be used to actuate a lease shut-in circuit.

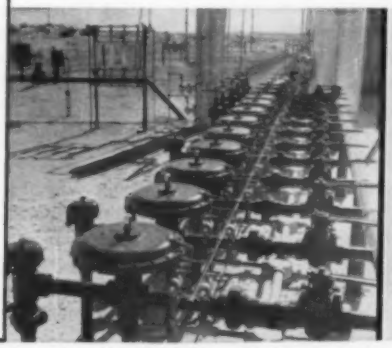
Internal Construction of CSC "Cyclotest". Individual relays are hermetically sealed and plug-in. This minimizes the need for maintenance and at the same time makes servicing of this unit quite simple. The sub-base on which the plug-in components are mounted is hinged and swings out for easy access to all internal wiring.



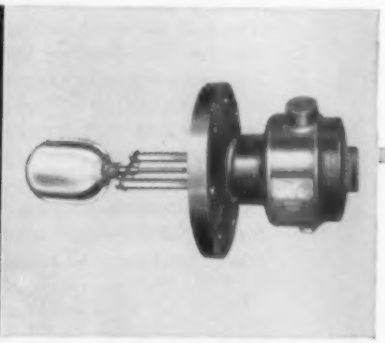
FOR COMPLETE DETAILS WRITE FOR BULLETIN 901



The Type 1620, pictured above, is a three-way, three-position valve. With no pressure on the diaphragm both ports are closed, so that this valve can be used for production control in addition to automatic well testing. The body is rated at 1500 lbs. W.O.G. working pressure and has 2" screwed connections.

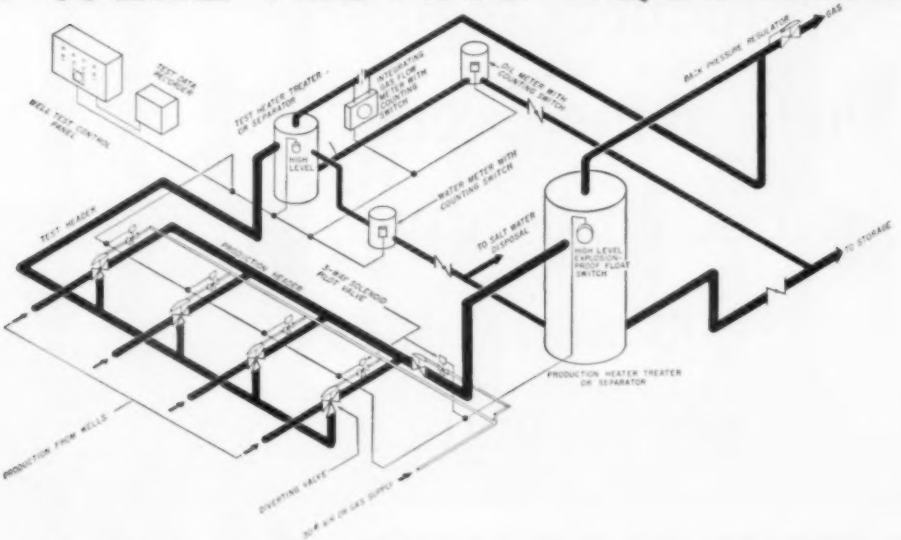


Pictured above are Diverting Valves for Well Test Manifold. Fisher offers two valve types for this service. For straight three-way service at low pressures the Type 1663A is recommended. This valve is spring loaded, diverting to the (test) position only when air is applied under the diaphragm.



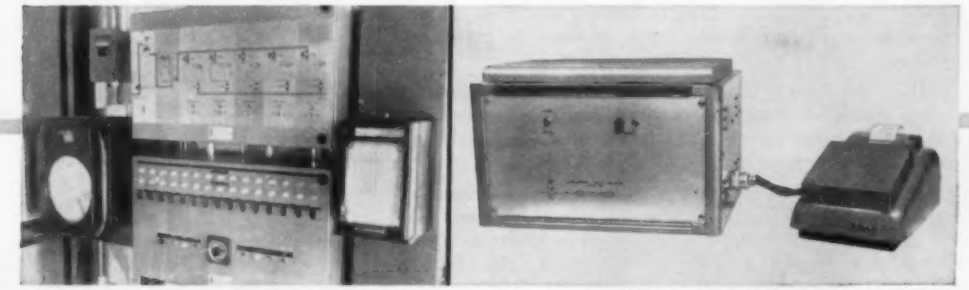
Float Level Control. The Fisher Type 2800-252V, an on-off type float switch, uses a flexure tube assembly for transmitting float motion to a Micro switch in an explosion-proof housing. Also available with Type 2805 pneumatic snap-acting pilot—interchangeable on same housing.

AND WELL TESTING EQUIPMENT



The left illustration below shows the controllers and recorders for a combination automatic tank switching and automatic well testing installation. The graphic panel is a CSC "Cyclotest" Automatic Well Test Controller for programming the testing of 15 wells. The recorder on the left is the integrating gas flow meter. On the right is a multi-pen operation recorder providing a permanent record of well test data.

The pilot lights on the "Cyclotest" indicate which wells are flowing straight to the Production Separator and which well is on test. The row of switches directly under the lights provide for by-passing wells from test sequence, for shutting wells in or for putting them on test independent of the controller. In the lower center is a 1-30 hr. timer which determines the duration of the test.



"Cyclotest" Automatic Well Test Controllers *"Cycloprint" Data Printer*

Pictured on the right in the above illustration is a "Cycloprint" Automatic Data Printer which is a multi-channel unit designed to receive pulse information from as many as 21 different sources and store this information until called for. A typical application is the recording of well test information such as barrels of oil and water, MCF of gas, test time, lease identification, date and time. The information is printed in digital form on adding machine tape.

CSC

FOR CONTROL SYSTEM DESIGN:

CONTROL SPECIALTY CORPORATION

(A Subsidiary of FISHER GOVERNOR COMPANY)

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Extra durability results in longer service, reduced replacement costs, minimized downtime. Du Pont neoprene has a balanced combination of durable properties. It is backed by a 26-year reputation of excellent performance under the severest conditions. Among its properties are resistance to oil and chemicals, heat, weather and sunlight.

Gaskets of resilient neoprene resist compression set, apply sustained pressure... keeping joints tighter longer. Neoprene resists abrasion by sharp, rapidly moving particles. It will not soften or become tender when exposed to petroleum products.

All-purpose hose has a neoprene cover to withstand weather, rough handling, heat and exposure to oil and chemicals. The neoprene tube withstands heat, oil, chemicals and solvents that attack ordinary rubber.

Because neoprene resists a wide range of deteriorating factors, and gives long-term, economical performance, it is used in the manufacture of such oil-field products as piston rubbers, pipe wipers, portable storage tanks. All of these products give long, dependable service.

Du Pont also manufactures HYPALON®, a special-purpose synthetic rubber. Hose made with HYPALON gives exceptional service when oxidizing acids are encountered.

Your rubber goods supplier carries a complete line of products made with neoprene. He can suggest the correct item to meet your particular needs, and offers rapid delivery on small or large orders. Take advantage of his services by calling him soon. For more information on the properties and uses of neoprene and HYPALON, write for *Du Pont Elastomers in Industry* to: E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. OG-10, Wilmington 98, Delaware.

Du Pont synthetic rubbers do more things better . . .
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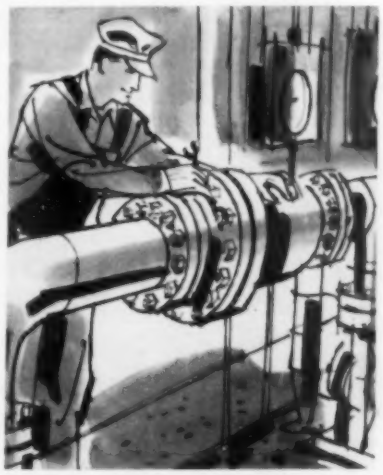
Neoprene hose subject to high-pressure steam withstood 3600 testing hours without appreciable ill effects. Hose of ordinary rubber deteriorated and burst.



Gaskets of neoprene are highly resilient. They resist deformation under load, retain sealing properties for long periods, do not soften or become tender when exposed to petroleum products.

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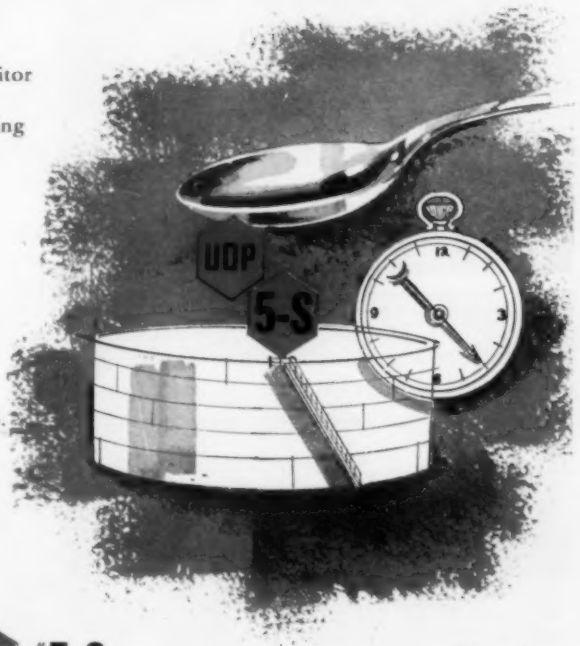

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Task-Force 59 brings you more to work and save with in every weight class—more models, thriftier engines, stronger cabs and frames, safer brakes, tougher axles and transmissions! Here's the longest, strongest line of Chevrolet trucks ever built, the best yet of the best sellers!

Good news in the light-duty class! Chevy's longer, stronger '59 line gives you a *dozen* big pickups to choose from . . . new 4-wheel drive models, newly fashioned panels, Step-Vans, and Sedan Deliveries! Scores of innovations include new hard-pulling Positraction rear axle, new bigger brakes, new stronger cabs, new broad-shouldered styling refinements!

Bright new middleweight and heavyweight might! New Series 50H and 60H models with heavy-duty components give G.V.W.'s up to 21,000 lbs. . . . while new Low Cab Forward trucks in Series 50 and 70 make pulling maximum-length trailers easier and more economical than it's ever been before! There are new 5-speed transmissions for extra pulling power; here, too, are huskier, longer lasting clutches; 15,000-lb. rear axle with new durability features—and mammoth 16,000- and 18,000-lb. rear axles.

New thriftier 6's, all-new V8 power! Chevy's best selling 6's are set to pinch pennies like never before with new camshaft design, new valve train durability . . . horsepower and torque to spare! *Six* big V8's match short-stroke power to your job; they're even tougher built and more reliable for '59, with high horsepower ratings that range from 160 to 230. And an *all-new* V8—the 185-h.p. Workmaster Special* is available in Series 70 and 80 models.

See the bright new trucks of Task-Force 59 at your Chevrolet dealer's now! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

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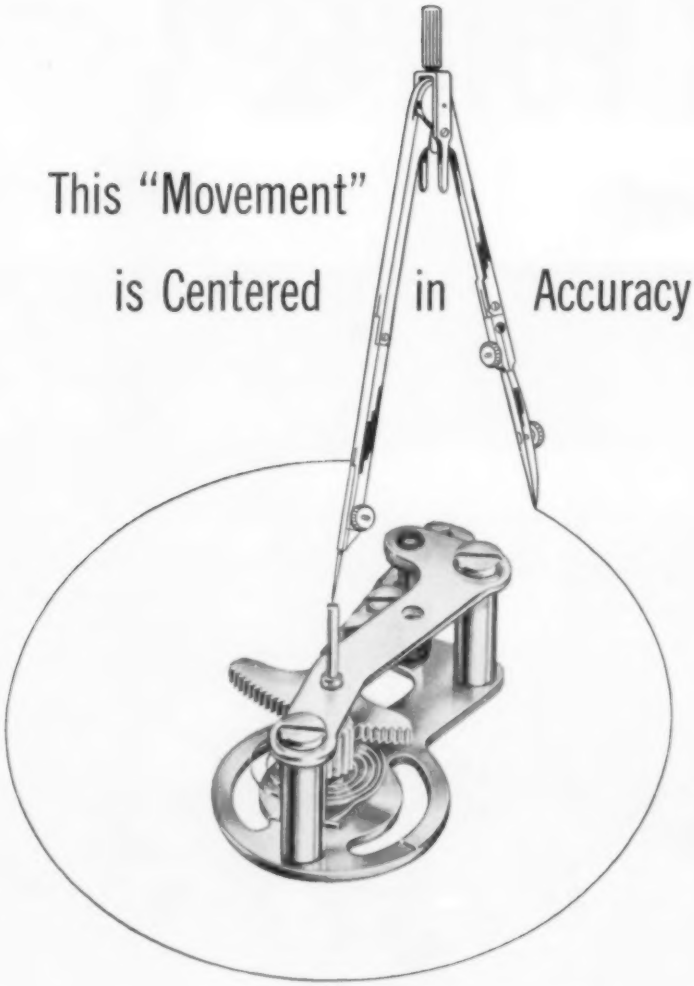
TRUCKS FOR '59!

New Money-Saving Power!

CHEVROLET TASK·FORCE 59 TRUCKS

This "Movement" is Centered in Accuracy



The rotary movement in Ashcroft Duragauges has a geared center shaft on which the pointer is mounted. When pressure flexes the Bourdon tube, the pointer is always positively positioned. You can rely on the Duragauge for precise accuracy in measuring pressure no matter how severe the conditions of service.

Correct calibration is guaranteed: the one-piece link between movement and Bourdon tube prevents slippage or parting under tension. Recalibration is easy from front or rear. Universal adjustability permits uniformly graduated dials.

You can order Ashcroft Duragauges with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. A complete choice of Bourdon tube materials, pressure ranges, dial sizes and case designs and materials is available. Your industrial supply distributor will gladly help you select the best combination for your requirements. So, be certain of highest sustained accuracy, durability and economy – specify Ashcroft Duragauges.

Ashcroft Duragauge in Alumalife® case—a lifetime case made of special aluminum alloy.

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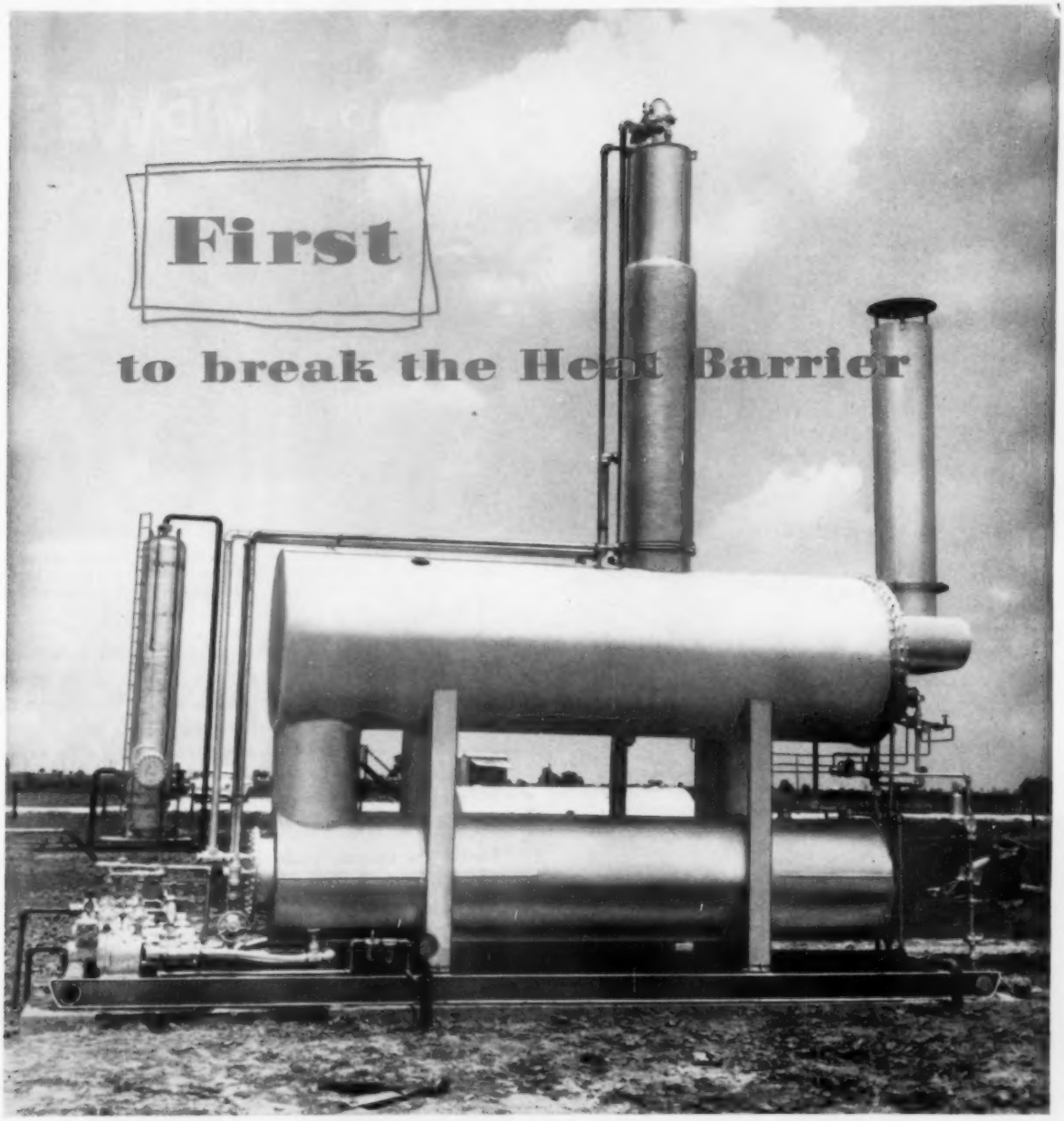

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"SPECIAL" Welding Fittings by MIDWEST

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"SPECIAL" MATERIALS

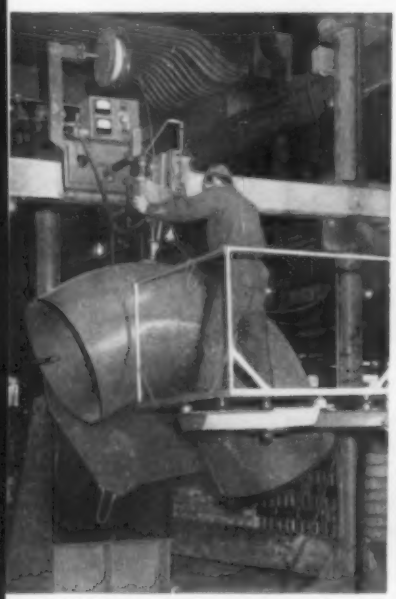
"SPECIAL" QUALITY

"SPECIAL" DELIVERY

Special gauges and instruments are used to make sure that we have complied with the extremely close tolerances often required on stainless fittings. Here wall thickness and concentricity were held within extremely close limits throughout the fittings.

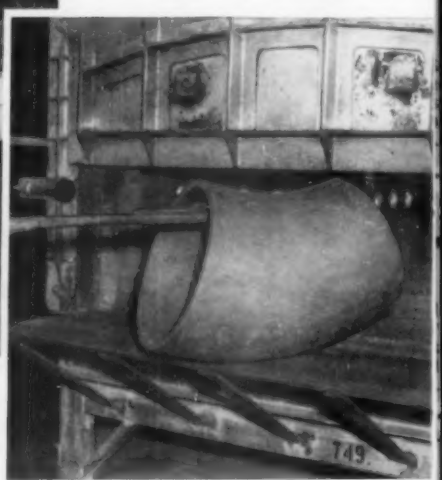
The exclusive Midwest method of manufacture—much more versatile and flexible than any other—enables us to make almost any type of special welding fittings to the most rigid specifications. Midwest makes welding fittings from *plate* . . . usually much easier to get than pipe, particularly if the material is special. That expedites delivery. Closer tolerances are inherent in the Midwest process, and quality control is always beyond code requirements.

Even if you use only standard fittings, the exceptional quality of Midwest fittings can be important to you. Ask your Midwest distributor or write us for new Bulletin 5801.



36" O.D. 90° elbow with 16" tangent on one end being welded by an automatic submerged arc machine. Material is A-201 carbon steel.

Stainless-clad elbows undergoing ultrasonic inspection to check bonding of material and quality of weld. Since plate is often the only form in which clad material is available, the Midwest process is able to produce the most comprehensive range of clad fittings—and to do so promptly.



Special 24" x 21" 45° reducing elbow made of 1" thick 1¼% chrome ½% moly steel ready for heat treating furnace.

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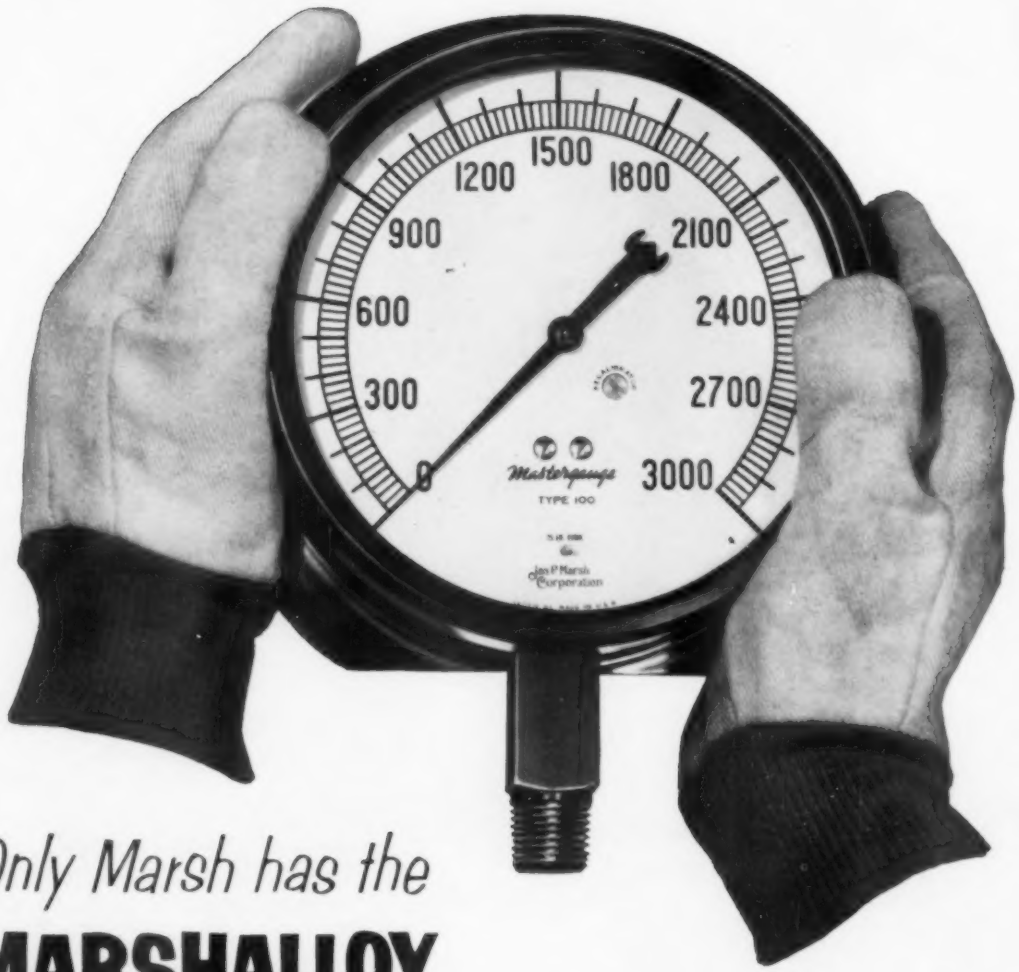

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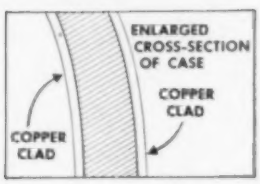
Four times stronger than cast iron
One-third lighter

There's nothing temperamental about a pressure gauge . . . provided it's built right and given proper protection. The basic units of Marsh Gauges—socket, tube and movement—are known for the care given to their manufacture. Such units deserve the best protection . . . and *get it* in the Marshalloy case. Here is a steel case of boiler-plate-thickness, heavily clad with copper inside and out . . . lighter, but many times tougher . . . protected against the ravages of corrosion. It is available only in Marsh Gauges.



The strength of steel; the corrosion resistance of solid copper . . . that's the Marshalloy copper-clad case.

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MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corp.*
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Why Spangwelding reduces your drill pipe costs

THE NATIONAL NSCO SUPPLY COMPANY

Spangwelding is the fusion of tool joints with drill pipe, and it's one of the most precisely controlled operations we perform.

Both the pipe end and tool joint are first carefully pre-heated, then inserted in the special electric resistance welding machine shown above. The actual welding is completely automatic, with power input and timing predetermined. Current flows across the contact area, heats and softens the contact zone, upsetting it as the two members are forced together and fuse into a single, high-strength piece. After flash metal removal and sufficient cooling, the joint is automatically stress-relieved by controlled induction heating. Finally, with the nondestructive Reflectoscope test, we "see through" the weld zone to be certain of its uniformity.

What does all this mean to your drill pipe costs? (1) You can count on uniform high quality and strength in all Spangweld Drill Pipe—with no worries of loss due to inferior welds; (2) Spangweld connections reduce expensive threading operations, thus tending to lower initial cost of the pipe.

Spangwelding is just one of many National Supply processes which insure tubular product superiority.

Spang Drill Pipe gives you best protection against drill string failures!

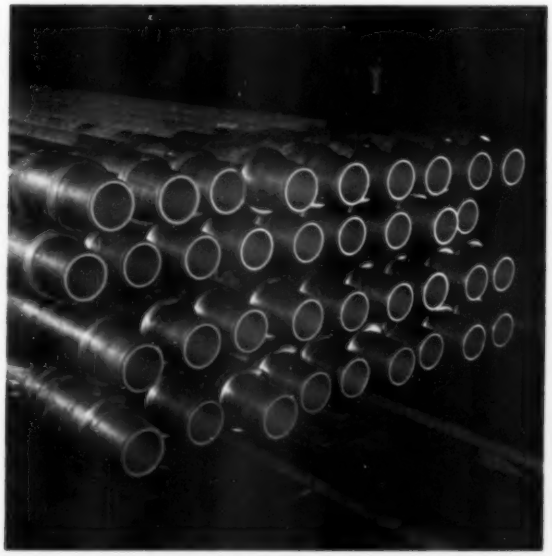
Leakage, fatigue, tension, corrosion and all the other troubles that can ruin profits on a well are minimized when you use Spang Drill Pipe. It is specifically engineered for highest resistance to all these problems, with these outstanding tool joint features:

Spangweld Tool Joints are welded to the drill pipe by an automatically controlled operation insuring accurate alignment and a high quality weld. The welding permits a streamlined contour and a reduced number of threaded elements. This tool joint connection also allows the smallest practical O.D. and maximum bore —a definite advantage for slim hole drilling.

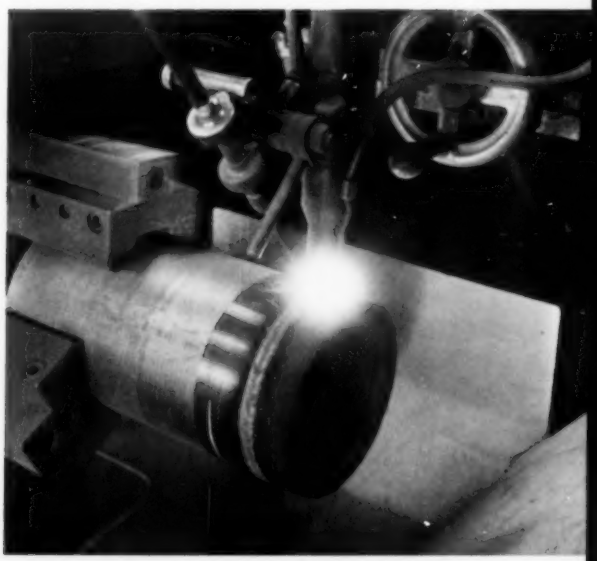
Spang Double Seal Shrink Thread Tool Joints can be easily removed and replaced in the field. Joint design has an outer seal, threads and inner seal all on a single cone. This insures uniform, reliable installations both at the mill and in the field, and completely seals against internal and external pressures.

Contractors have consistently found these quality features of Spangweld and Spang Double Seal Shrink Thread Drill Pipe to be exceptional advantages on difficult drilling jobs. Do you want proof—and plenty of it? See the National Supply representative in your area now.

Add service life to your Spang Drill Pipe with these special processes . . .



Spang Plastic Coating gives the best protection against corrosion. Scientifically applied at the mill on specially-developed facilities, Spang Plastic Coating is available in Spang Drill Pipe (shown here), Casing, Tubing and Line Pipe.



Spang Hardfacing is a superior protection for tool joints in abrasive formations. It consists of multiple bands of tungsten carbide, continuously overlapped on the joint to form a solid particle-to-metal band.

◀ Spangweld and Spang Double Seal Shrink Thread Drill Pipe are available in a full range of sizes, including diameters for slim hole operations.

National Drill Collars on the next page . . .

National Drill Collars are simultaneously bored from both ends on this 165-ft. trepanning lathe designed especially for this purpose. The lathe's speed and accuracy obsolete the ordinary type of solid bar drilling.

Use precision-made National Collars for best penetration rates!

Are you looking for ways to improve penetration rates at all drilling speeds, and extend the life of your drill string? Specify National Drill Collars and you'll see new results because of these features:

High strength properties—National Collars are made from alloy steel, hardened and tempered *full length* (not just ends only) for high strength. As an additional safeguard against fatigue failure, National "Tuf-Flexes" its drill collar joints by cold-rolling or peening.

True center bores—These are established by a special 165-ft. trepanning lathe which precisely bores both ends of the collar simultaneously. All bores are carefully surveyed for concentricity to insure proper balance while rotating at normal and high drilling speeds.

Stress relief grooving—To improve the fatigue resistance of drill collar joints, National machines a stress relief groove at the last engaged thread zone of both box and pin members. The pin relief groove is designed to protect the shoulder corner as well as the stress concentrating zone at the last engaged thread.

Along with performace records, features like these are proof that you can't buy a better drill collar than National's. So get the best—and the operating benefits that go with it. See a National representative about the drill collar sizes to meet your needs. He can also give you some valuable tips on collar care and handling.

Replaceable End Collars

National also manufactures a complete line of drill collars with replaceable ends—incorporating a modification of the time-tested double seal shrink thread principle—for use in isolated areas where field shop facilities may not be available.

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1

They Say—

Import Ideas Aired

. . . wrong allocation basis

"You propose to base allocations on a per cent of refinery runs yet to be determined by the refiner.

"In our opinion, this would instantaneously cause increased refinery runs and create an oversupply of products which would be conducive to further depressed refined product prices.

"We recommend that the basis be the refining capacities as reported by the Bureau of Mines or the average daily runs of a 'predetermined' 12-month period, whichever is greater."

J. A. Vickers, president, Vickers Petroleum Co., in a letter to Capt. Carson.

. . . new plan is confiscation

Dear Sir:

Proposed revisions of the voluntary oil import program appear at first glance to be fair and practical. This veil of apparent fairness covers a confiscatory plan under which the fruits of investments by a few companies would be distributed to all refiners east of the Rocky Mountains.

A key fact which the proposed revisions fail to recognize is that some American oil companies have taken the risk and initiative and have made very heavy investments in developing overseas sources of crude oil.

Yet, under the new plan, Atlantic and other companies in a similar position would be allowed to import no more foreign crude in proportion to refinery runs than companies that have taken no risk and have made no investments to obtain foreign oil. Many such companies are inland refiners having little or no need or economic justification for using their foreign import allotments.

The obvious course of action would be to sell these import allotments to Atlantic and similarly situated companies, who would thus pay twice for use of oil they had discovered and developed, while providing an unearned windfall to competitors.

Also, it is certain that oil companies with a number of refineries scattered throughout the country will transfer allotments of imported oil from their inland refineries and concentrate their imports in their East Coast refineries to gain transportation advantages.

This pyramiding of low cost imported oil at one or more refineries on the East Coast would give these companies a distinct competitive advantage.

Henderson Supplee, Jr.
President
Atlantic Refining Co.

. . . proposed plan is fair

Dear Sir:

The enclosed letter to Captain Carson may be of particular interest to you . . .

Orin E. Atkins
Ashland Oil &
Refining Co.
Ashland, Ky.

Dear Captain Carson:

After careful study, we believe that your proposed plan is the most equitable and practical solution to the oil import problem that can be adopted at this time.

Originally the crude oil import problem pertained principally to the proper division of the domestic crude oil market between foreign and domestic oil producers. Refiners, as such, were not greatly concerned as long as price parity continued to prevail between foreign and domestic crude oil at the refining centers where the existing level of imports of foreign crude could be refined most economically and so long as there was a corresponding parity in the prices of refined products.

Refiners of domestic crude became directly involved when foreign crude oil became generally available at prices which were substantially lower than those for domestic crude oil, and when lower prices of foreign oil were reflected in the prices of products refined from that oil as well as in the prices of imported refined products.

Allocation of import quotas then became an allocation of refining profits and thus became an allocation of domestic markets.

With the breakdown of historical pricing patterns for foreign crude oil and its refined products, including unfinished oils and imported products, there is no longer any validity to the claims that import quotas should continue to follow historical patterns.

Everett F. Wells
President Ashland
Oil & Refining Co.
Ashland, Ky.

. . . add a bonus amendment

Dear Sir:

The attached letter to Captain Carson presents a suggested amendment that would allow bonus imports to companies producing oil domestically from oil shale, coal, and gilsonite. This amendment, we believe, would:

. . . **Encourage** the establishment of a domestic synthetic fuels industry.

. . . **Contribute** to national security.

. . . **Alleviate** the hardship of those companies with large refining capacities who need more imports than are now allowed by normal allocation.

Russell J. Cameron
President
Cameron & Jones
Consultants
Denver.

Dear Captain Carson:

The substance of our suggested amendment is that companies who would be willing to produce oil domestically from oil shale, coal, gilsonite, or like petroleum supplements, would be allowed imports over and above their normal allocation.

This amendment might be embodied in your proposed plan reading:

An importer may, upon application, receive a bonus import allocation in addition to his normal quota, for initiating the domestic production of oil from oil shale, coal, gilsonite, or like petroleum supplements. Bonus imports may begin upon acceptance by the administrator of evidence of the start of construction on a bona fide supplementary oil production facility. Until production actually begins, the bonus allocation will be 50% of design capacity. After the facility begins operation, the bonus allocation will be equal to production . . .

Russell J. Cameron
President
Cameron & Jones.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

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CALENDER

OCTOBER

12-18 OIL PROGRESS WEEK.

13-15 American Gas Association, annual convention, Atlantic City, N. J.

13-15 American Society of Mechanical Engineers, American Society of Lubricating Engineers, conference on lubrication, Statler Hotel, Los Angeles.

13-16 Society of Exploration Geophysicists, annual meeting, Hotel Gunter, San Antonio, Tex.

13-17 American Society of Civil Engineers, annual convention, Hotel Statler, New York.

15-16 South Dakota Independent Oil Men's Association, convention, Sheraton-Johnson Hotel, Rapid City.

15-16 University of Kansas, Southwest Kansas Center, sixth annual Gas Measurements Institute, Liberal, Kans.

15-17 National Association of Corrosion Engineers, north central region, Cincinnati.

15-17 Petroleum Conference on Well-Logging Interpretations, third annual conference, McMurry College, Abilene, Tex.

16-17 Society of Petroleum Engineers of AIME, Southern California petroleum section, Biltmore Hotel, Los Angeles.

16-18 New Mexico Geological Society, Arizona Geological Society, ninth annual field conference, Black Mesa basin, registration Gallup, N. M., Oct. 15.

16-19 Permian Basin Oil Show, Odessa.

19-21 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Adolphus, Dallas.

20-21 Instrument Society of America, national rubber and plastics instrumentation symposium, Akron, Ohio.

20-24 National Association of Corrosion Engineers, south central region, Roosevelt Hotel, New Orleans.

20-24 National Safety Council, forty-sixth National Safety Congress, Conrad Hilton Hotel, Chicago.

20-31 New York University, second seminar on retailing for petroleum executives, NYU Washington Square Center.

22-23 National Association of Corrosion Engineers, western region, corrosion control course, U. S. Grant Hotel, San Diego, Calif.

22-24 Society of Automotive Engineers, national diesel engine meeting, Lord Baltimore Hotel, Baltimore.

22-25 Southwestern Federation of Geological Societies, regional meeting, Mineral Wells, Tex.

23-24 Rocky Mountain Oil and Gas Association, annual fall meeting, Town House Motel, Omaha.

23-24 Western Petroleum Refiners Association, refining technology and industrial relations meeting, Rufus Garrett Hotel, El Dorado, Ark.

26-28 Gulf Coast Association of Geological Societies, Driscoll Hotel, Corpus Christi, Tex.

27-28 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-31 American Institute of Electrical Engineers, general meeting, Pittsburgh.

31 Natural Gasoline Association of America, Southern regional meeting, Carlton Hotel, Tyler, Tex.

NOVEMBER

5-6 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

6-7 American Association of Petroleum Geologists, Pacific section annual meeting, Los Angeles.

6-7 Louisiana Polytechnic Institute, School of Engineering, seventh annual instrumentation conference, Ruston, La.

10 Transportation Club of the Petroleum Industry, annual meeting, Bismarck Hotel, Chicago.

10-12 American Petroleum Institute, thirty-eighth annual meeting, Conrad Hilton, Palmer House, and Congress hotels, Chicago.

18 Chemical Institute of Canada, chemical economics subject division, meeting on "The Canadian Chemical Industry—Export and Growth, Sheraton-Mount Royal Hotel, Montreal.

18-20 Ninth National Conference on Standards, Hotel Roosevelt, New York.

18-20 National Conference on Air Pollution, Sheraton-Park Hotel, Washington, D. C.

19-21 Society of Petroleum Engineers of AIME, Venezuela petroleum sections, Caracas, Venezuela.

20-21 American Society of Civil Engineers, structural division and Kansas City section, conference on electronic computation, Kansas City.

21 Natural Gasoline Association of America, Panhandle Plains regional meeting, Herring Hotel, Amarillo, Tex.

30-Dec. 5 American Society of Mechanical Engineers, annual meeting, Statler and Sheraton-McAlpin hotels, New York.

DECEMBER

1-3 Interstate Oil Compact Commission, annual meeting, Kansas City.

2-4 Asphalt Institute, annual membership meeting, Shoreham Hotel, Washington.

7-10 American Institute of Chemical Engineers, annual meeting, Netherland Plaza Hotel, Cincinnati.

9-13 National Association of Corrosion Engineers, University of Illinois, biennial short course on cathodic protection.

11-12 Mid-Continent Oil and Gas Association, annual advalorem tax forum, Hilton Hotel, Fort Worth.

JANUARY

22-24 Texas Society of Professional Engineers, annual convention, Shamrock Hilton Hotel, Houston.

23 Natural Gasoline Association of America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

28-29 Annual Midwest Welding conference, sponsored by Armour Research Foundation of Illinois Institute of Technology, and American Welding Society, Chicago section, Illinois Institute of Technology, Chicago.

FEBRUARY

1-6 American Society for Testing Materials, D-2 committee on petroleum products and lubricants, Sheraton-Jefferson Hotel, St. Louis.

9-11 American Association of Petroleum Geologists, Rocky Mountain section, ninth annual meeting, Civic Auditorium, Albuquerque, N. M.

15-19 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Sir Francis Drake Hotel, San Francisco.

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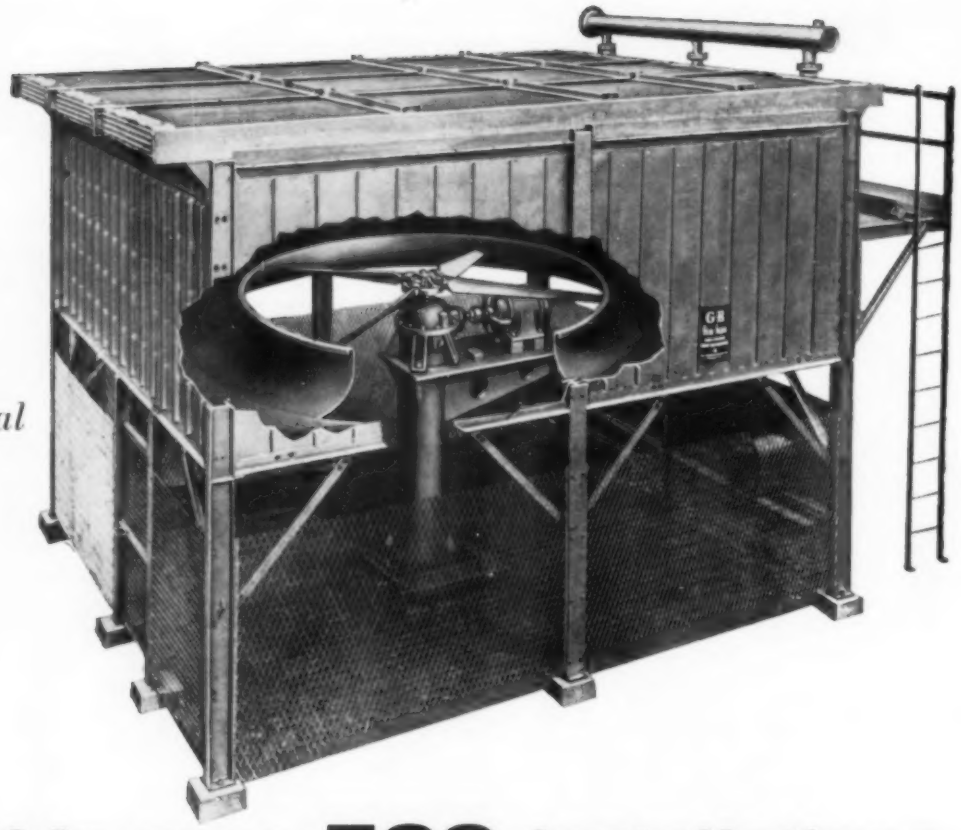

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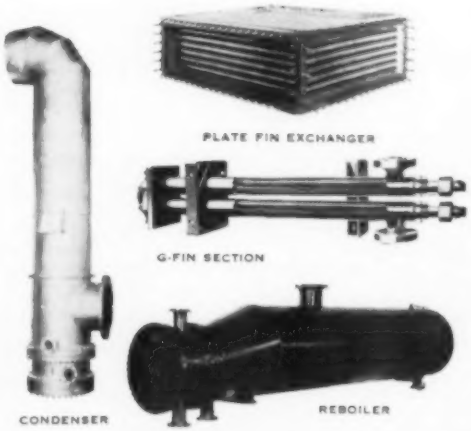

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TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone LUther 4-4411. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY SPEAKING

Even the Dhobi Ghat

GAS COMPANIES are crying in their beer about all their many problems—dependence on a winter heating demand, difficulties of promoting the use of gas appliances, need for a big industrial load, and so on.

But their troubles don't hold a candle (oops—better say a gas flame) to those of Sui Gas Transmission Co. and its distributing customers in Karachi and Hyderabad, West Pakistan. By the Beard of the Prophet, do they have problems!

In the first place, nobody in Pakistan had ever used gas, wanted to use gas, or could figure out any way that gas could be used. Oil was what was wanted when Burmah Oil Co. discovered the big Sui gas field in the Baluchistan Mountains 5 years ago. Oil would have found a ready market, because Pakistan has to import all her oil, and use scarce foreign exchange to pay for it.

But gas in Baluchistan seemed even more useless than gas in the Texas Panhandle did 30 years ago.

Consider: Sui field was 250 miles from Pakistan's nearest cities. And the climate there is such that winter demand for any kind of fuel for heating is approximately nil. So scratch the heating load.

Industrial load? The industries are chiefly of the back-room, family type. Not many promising prospects there.

Cooking? Well, Pakistanis eat, but most of their chappatis pancakes, goat stew, frizzled jalabis, and immertis were prepared over charcoal braziers.

Appliances? The average per capita income in the cities is $85 per year. Housewives tote water from the spring in jugs on their heads. So forget all about oven-control ranges, automatic water heaters, clothes driers, and all the rest.

What's left in the way of market prospects? Darned little. In this country our FPC and SEC would have disapproved the project in a hurry. But the International Bank for Reconstruction took a chance and loaned 14 million U. S. dollars. Transmission and distribution companies were formed, a 16-in. line was laid the 250 miles over the mountains, and pipes were strung through the city streets.

And it begins to look as though the project may pay out.

The domestic rate is about $1.67 per M.c.f., but that's some 25% cheaper than kerosine which the upper class used for cooking. The lower class cooked with charcoal, but it is so scarce it is rationed. Charcoal was supplemented with dried camel dung, but the camels just couldn't keep up with the demand.

So the cooking load is growing steadily. Each customer has to pay for his own installation, so to save money one meter is often shared by 8 or 10 houses, and the families split the bill among themselves. The company was doubtful of its customers' credit, so requires an advance payment of $3.25—but in urban New York it takes a $10 deposit to get the gas turned on.

The industrial rate—42 cents per M.c.f.—was pegged at the price of fuel oil, but even so the many small industries are taking to gas in a big way. A major industry is the manufacture of all kinds of glassware, particularly bangles and other ornaments which are shipped out by the camel-train load.

Biggest users are power plants, for electricity has been rationed severely. Most industries have their own generating plants, and they are now operating them with gas instead of fuel oil.

Strangest of all, a laundry market is developing. Newest commercial customer in Karachi is the dhobi ghat. This is a big field near the river where Karachi housewives do their washing and spread it out on the sand to dry. Now they are going to have hot water.

Yes, it takes vision, patience, and promotion to develop a market for gas, whether in primitive Pakistan or modern Manhattan. But a good fuel, competitively priced and aggressively merchandised, will make a place for itself anywhere.

For all its troubles, the Pakistan gas industry has one big advantage over the U. S. gas industry. So far the courts haven't tried to run the business.

Henry D. Ralph.

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Proration can't assume refiners' responsibilities

FOR the past 3 months the oil industry has experienced something of a phenomenon. Crude stocks have been at a very low level. East of the Rockies they have been below what the refining division has described as "desirable."

Yet refinery runs and stocks of refined products have been high, and markets for both crude and products are weak.

This suggests that proration of crude production cannot by itself accomplish the degree of stabilization of the industry that seems to be expected of it.

REFINERS HAVE THE RESPONSIBILITY and the ability to keep runs and products stocks in line with market demands. State conservation agencies have neither this responsibility nor ability.

State authority cannot and should not go beyond the prevention of the physical and economic waste that results from unnecessary aboveground storage of crude oil. Recently, the prorating states have done an excellent job of holding production to the best estimates of demand that were available to them.

Refiners also have a responsibility to prevent the waste that results from holding huge quantities of refined products in steel tanks. Of course they must also maintain a sufficient inventory cushion to take care of sudden, short-term spurts in demand. And this cushion should include a certain amount of crude in refinery tank farms.

Just what these inventories should be is a matter for the collective judgment of refinery management. Conservation bodies have done their part when they tailor crude output to the stock levels which the industry suggests as optimum.

Current pressures to tighten proration still further, despite the low crude stocks, in order to reduce refinery runs and products stocks gives support to the old gag that "giving a refiner crude is like putting candy in front of a baby." It implies that refiners won't carry crude inventories and won't heed market requirements. It is tossing the whole problem of industry management into the laps of the state bodies.

IT WOULD BE GOOD if conservation commissions would pay more attention to the over-all economic condition of the industry than they have in the past. But they certainly are not equipped to make detailed analyses and forecasts of the products markets.

And it would be neither practical nor desirable to try to keep the whole industry stabilized by a fine tailoring of production allowables.

If the industry doesn't need as big crude stocks as formerly, this should be made known to, and followed by, the conservation bodies. But refiners must carry an adequate cushion of crude inventories, and they must bear the responsibility of avoiding excessive products stocks.

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reports S. Edward Roth,
Chief Instrument Engineer,
Tidewater Oil Company
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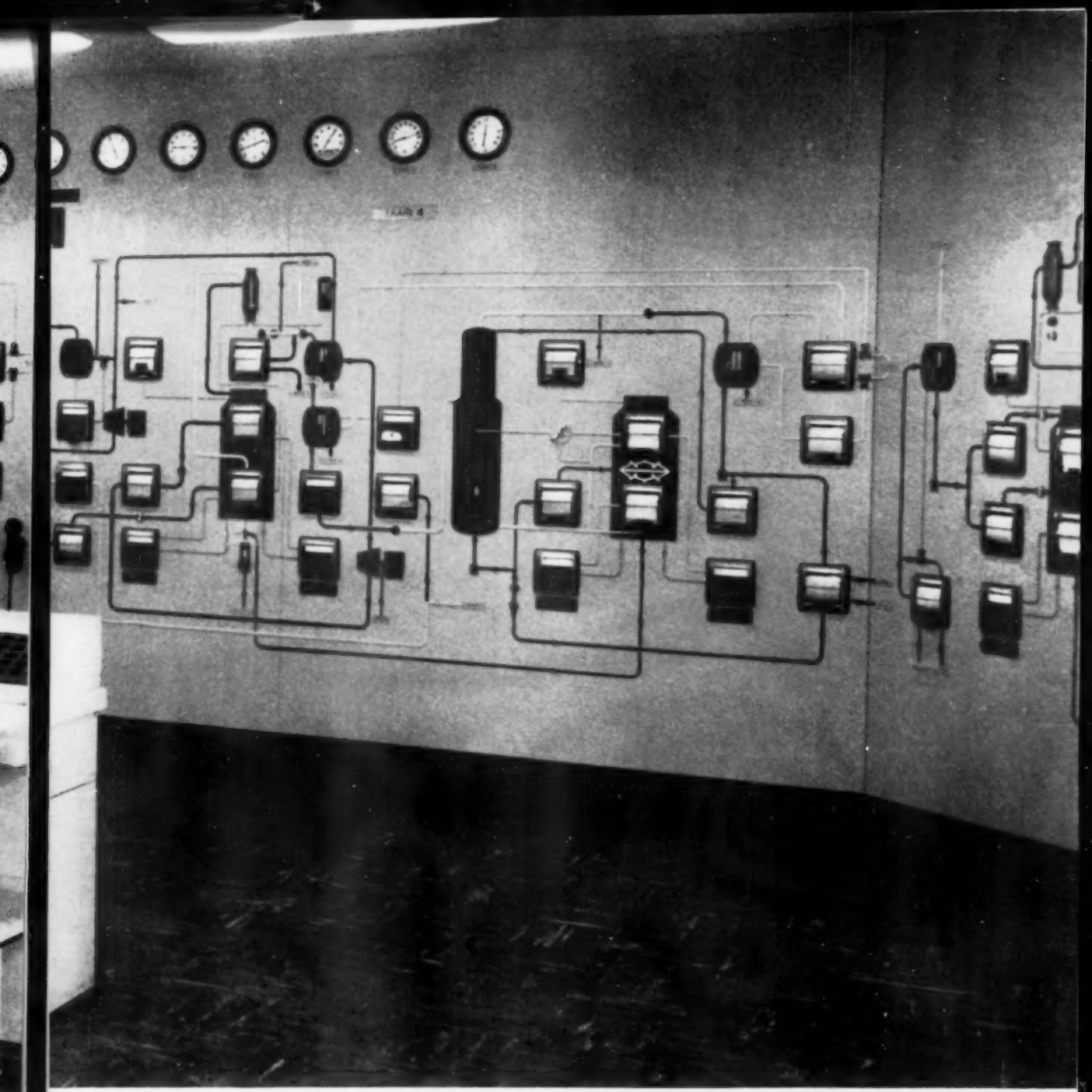

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tures especially helpful when "tuning" controllers to a new process.

And second—at the Tidewater Control Center shown here, there are 1, 2, and even 3-pen recorders; 1 and 2-pointer indicators; as well as recorders and indicators with integrally-mounted Model 58 Consotrol Controllers.

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SHOWN ABOVE: Graphic control panel for catalytic desulfurizer unit. Tidewater Delaware Refinery. Over 400 Foxboro Consotrol Instruments are used in this ultramodern refinery.

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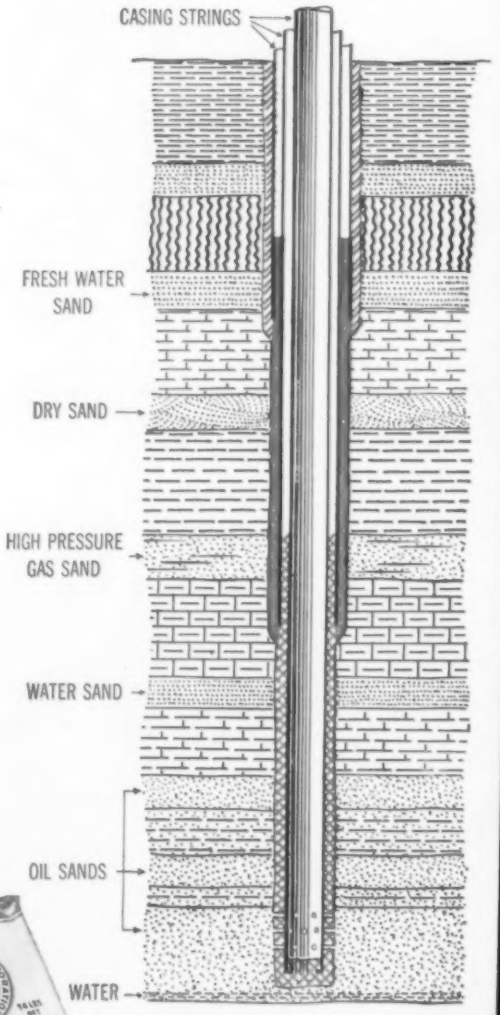

Oil well conditions typical of those encountered in the Gulf Coast, East Texas, and similar areas.

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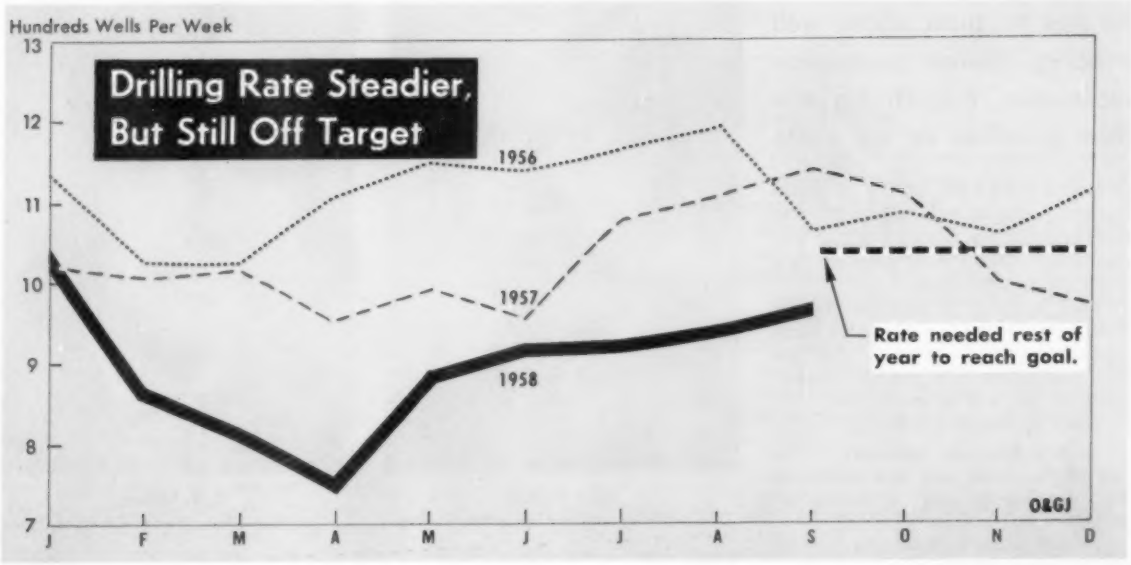


Needed: 1,037 Completions a Week

. . . if oil operators reach 48,950 goal set at midyear. Best guess: Drilling will be short by only 550 wells.

A LOOK at current drilling statistics leaves two conclusions. Oil operators have:

. . . **Lowered** their sights slightly since midyear, or,

. . . **Planned** to step up drilling in the last quarter.

Evidence tends to indicate that operators generally have pared back their drilling programs since midyear.

Although the drilling rate recovered remarkably since the April bottom, drillers had completed only 35,917 wells by October 4. This leaves 13,032 wells to be drilled between now and the end of December if the drilling program planned at midyear is to be achieved.

During the fourth quarter, drillers must hit a weekly average of 1,037 well completions to fulfill the program. September completions averaged 971 per week, the highest since January when the average was 1,045.

The outlook . . . Despite a current completion rate of less than a thousand wells per week, there is still a chance that the activity will rise in the weeks ahead.

In the past, the general pattern of completions throughout the average year shows a dip in the early months of the year that lasts until after midyear. The completion curve then rises to a high plateau of completions in the late fall followed by a drop in December because of the holidays.

The normal October-November increase is expected this year, but it probably won't be sufficient to take up the slack in the over-all yearly program.

Here's what drillers face: If operators average a thousand wells per week for the rest of the year—which would be a good achievement—the full 12-month total would be 465 wells short. An average of 990 wells per week would leave the drilling total still another 125 wells lower.

These facts have led the Journal economics department to estimate the year's drilling activity at about 48,400 wells, about 550 wells below the original program.

The year's picture . . . Oil men reduced their drilling budgets during the first 6 months of the year.

This was shown by comparing individual company plans reported to The Oil and Gas Journal at the first of the year and again at the end of June (OGJ, Jan. 27, p. 146, and July 28, p. 126).

The changes for the first half of this year were across the board, affecting both the larger and smaller operators. This ran counter to a general industry rule that fewer larger operators change drilling budgets during a given year than the smaller concerns.

But the majority cut back this year. Out of a group of 50 selected companies, 68% revealed a definite reduction from the drilling program reported at the first of the year. Only 14% reported little or no change, and the other 18% recorded definite increases in drilling.

Since the Journal makes its large-scale check on drilling plans only twice each year, there is no definite proof that operators generally have made further downward revisions in plans for the year. However, reported completions for recent weeks indicate a leveling off at a weekly rate that is too low to bring the year's total wells up to that projected by operators at midyear.

Industry Leaders Team Up on Waste

- National committee being formed to push wider well spacing, newest production techniques, anything else that promises to cut costs.

A VOLUNTARY BODY of profit-squeezed oil men, half majors and half independents, are getting together with one object—bring more economy into domestic oil operations.

Their thinking: If domestic oil is to compete with foreign oil, and it must, domestic operators must do what foreign operators are doing—produce more oil per well at lower cost.

Their approach will be to:

. . . **Sell domestic operators** on the use of the latest and best techniques for developing and producing oil fields.

. . . **Sell conservation bodies** on killing antiquated rules or policies blocking use of these new techniques.

. . . **Sell state legislatures** on amending statutes which stymie streamlined operations.

First official disclosure of the new committee was made last week in Dallas by Charles W. Alcorn, Houston, in his president's address during the thirty-ninth annual meeting of the Texas Mid-Continent Oil and Gas Association.

Jake Hamon
. . . whose team will plot the course.

E. B. Miller
. . . whose ideas made him chairman.

Exactly how the group will proceed isn't known. The organization isn't yet that far along. But since the idea of a committee was formed, more than 100 oil men already have jumped aboard the band wagon. And there's a standing invitation to any oil man who's interested to join.

E. B. Miller, vice president of Tidewater Oil Co., Houston, is chairman of the committee. Jake Hamon, prominent Texas independent and former chairman of the American Petroleum Institute, is head of the steering committee.

DISTINGUISHED SERVICE to the oil industry brought recognition last week from the Texas Mid-Continent Oil and Gas Association. Harry W. Bass, second from left, received the honor as an independent producer, and L. F. McCollum, president of Continental Oil Co., second from right, was honored as a major company executive. Bass was presented his award by J. L. Latimer, left, president of Magnolia Petroleum Co. McCollum received his plaque from R. F. Windfohr, right, Fort Worth independent and former president of the association.

Though specific action has not yet been mapped, the committee has pretty well defined its general theater of operations. Miller told the Journal in Dallas last week that committee representatives, for instance, may attend and make recommendations at state conservation hearings involving general policy decisions.

Committee targets . . . Spending more money than is necessary to develop and produce a field, the committee thinks, is wasteful and does not serve the cause of conservation.

Furthermore, such waste can do nothing but continue the heavy foreign-oil pressure on the domestic producer.

Main committee targets, in its drive to get more production for less money, are these:

. . . Good unitization laws. These, Miller says, are needed in all states which do not have them.

. . . More efficient spacing. The concept that 20 or 40 acres for an oil well and 80 to 160 acres for gas wells constitute wide spacing must be changed. Where one well will effectively drain a given area in satisfactory time, it is wasteful to spend the money to drill two, three, or four. More wells than needed send per-barrel or per-M.c.f. costs skyrocketing. Operators, royalty owners, and regulatory agencies should all recognize that efficient and economical exploitation of a field insures benefit to each.

. . . Sound proration formulae. These should not give disproportionate weight to the well factor but should be based to a much greater extent on proved reserves.

. . . Modernized state regulations. State rules should not deny the operator the right to use to the fullest new developments in completion, measuring, and operating techniques and equipment. These include multiple completions, metering of oil and gas, automation of lease facilities, or any other method or device.

The need apparent . . . "When I look about and see 26 wells drilled on 13 acres (and this has happened recently), I must conclude that economic waste has taken place—not for the individual, perhaps, but certainly for the industry," Miller says.

"When I see an application for a permit to drill an 11,000-ft. gas well on 5 acres, I know that economic waste is going to take place. When it is necessary to install separate facilities for measuring oil and gas on each individual property when proved equipment could have been installed for half the cost, I know that we are not doing as well as we know how."

watching WASHINGTON

Bertram F. Linz

• Records examined in price-fix case

THE GOVERNMENT'S SUIT charging 29 oil companies with price-fixing has come to a halt while the Justice Department takes a final look at the records submitted to the Alexandria grand jury.

Judge Albert V. Bryan of the Alexandria federal District Court signed the formal order transferring the case to Tulsa early this month.

But while Julge Bryan instructed his clerk to send the court records in the case to Tulsa, he gave the department time to finish its processing of the thousands of documents which the grand jury called for during its inquiry which led to the one-count indictment.

The order was written by industry attorneys and given the Justice Department's okay. In it, the Government concedes that the alleged offense is charged to have been committed in more than one court district, including that covered by the Tulsa court.

• Air-pollution plan aim of Government

REFINERS will get a chance next month to tell what they are doing to reduce air pollution.

The U. S. Public Health Service has called a 3-day meeting starting November 18 in Washington. The avowed purpose: "To review the facts about the air-pollution problem and to agree on a practicable future course of action."

The aim of the PHS is to set up a 10-year plan of action, both in research and in control.

The oil industry has a big stake in the plan. In some areas all the blame for air pollution has been laid on refineries and automobiles. A few years ago the villain was coal, which could turn cities like St. Louis into nightmares at noon.

The PHS defends the oil industry to some extent. While automobile exhausts contribute to pollution, domestic and city incinerators and chemicals and gases from many industries also foul the air.

Air pollution is figured to cost the nation between $1.5 billion and $4 billion a year in increased laundry, cleaning, and painting bills, and damage to crops and livestock. And the damage to health can't be figured in dollars.

• Auto registrations are leveling off

MORE TRAVEL rather than more autos may soon be needed to increase the oil industry's gasoline market.

There are more cars, trucks, and buses on the roads each year, it is true. But the rate of increase in registrations is declining and is expected to continue to drop.

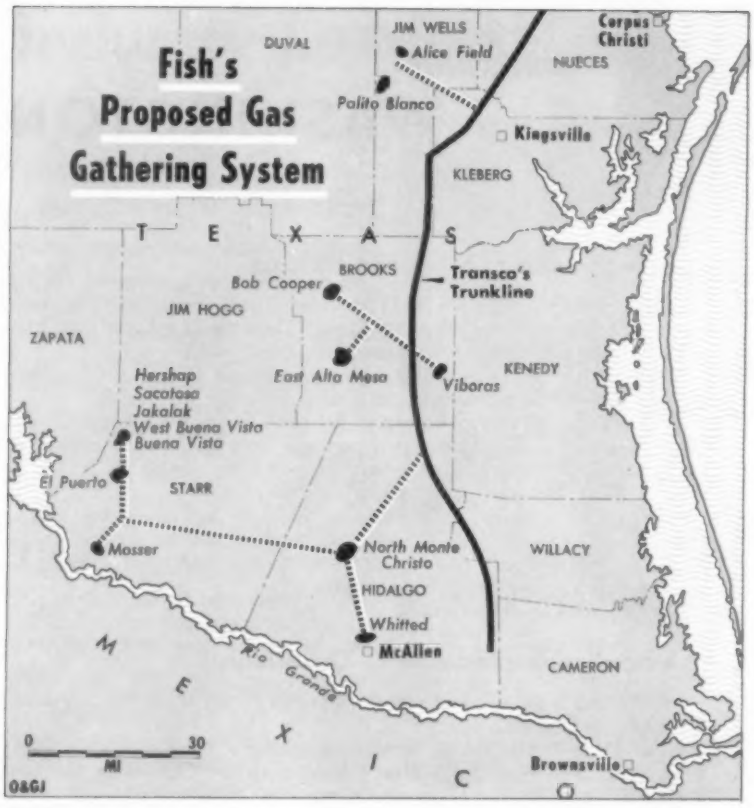
Federal highway officials have figures showing that registrations were up 7.2% in 1955 over 1954. But they point out that the increase in 1956 was only 4%. In 1957, the rise was only 3%, and this year it is expected to drop to 1.9%.

This downward trend is expected to continue, the experts say.

Total registrations are expected to hit 68.4 million this year. Passenger cars will total 56.98 million, against 55.9 million last year. Trucks and buses will number 11.43 million against 11.23 million.

More and better highways are being built, however. And they are expected to tempt car owners to drive the open road oftener and farther.

The best gasoline markets right now appear to be California, with 7 million registrations; New York, with 4.9 million; Texas, 4.1 million; and Pennsylvania, 4 million.



More Gas to Move East

. . . in new plan by Fish. Transco would haul South Texas gas to Long Island utility. Mexican supply also sought.

BY LATE 1960, Fish Engineering Corp. hopes to be moving 100 million cubic feet of gas daily through a proposed $15-million gathering system.

The gas would move from South Texas to Fish's customers in New York through Transcontinental Pipeline Corp.'s existing trunkline.

Fish began lining up small independent gas producers in four Texas counties last March and now has commitments on 32.5 million cubic feet daily for delivery, via Transco, to Long Island Lighting Co., which serves Long Island communities.

The plan . . . To handle the operation Fish has created a subsidiary, Valley Gas Transmission, Inc., which filed an application early this month with the Federal Power Commission for a certificate allowing it to market the South Texas gas.

The gathering lines will tap a dozen or more small fields which have no present outlet for their production.

By next summer Fish expects to build 150 to 160 miles of lines to meet its commitment to Long Island. The cost will run to $3 million or $4 million. This includes dehydration and separation plants in the fields.

If quick approval can be obtained from FPC, Fish will have crews ready to go into the field by December 1 and the work completed on the first 100 miles of gathering lines by mid-January. The rest of the project would be completed by summer.

Fish is not contemplating any trouble getting fast action from FPC. The company has firm contracts with the producers, a commitment from Transco to transport the gas to New York, and a contract with Long Island Lighting to take the gas. No price proposals have yet been filed.

The fields which the gathering system will tap are located in Starr, Hidalgo, Brooks, and Jim Wells counties, and the metering stations where it would tie into Transco are located in Hidalgo, Brooks, Kleberg, and Victoria counties.

The lines will range in size from 3.5 to 6-in.

New development of the area is expected to result from the Fish-Transco Long Island deal, which is only the first contemplated by Fish.

Mexican gas . . . Fish representatives currently are negotiating with Petroleos Mexicanos (Pemex) for Mexican gas to be transported to the New York vicinity just like that of South Texas.

If they succeed, Fish will become the second importer of Mexican gas. Texas Eastern Transmission Corp. is now taking gas from northern Mexico for its eastern markets.

Fish expects to get half of its contemplated 100 million cubic feet daily of gas from south of the border. Pemex would have the responsibility of delivering the gas to the border.

No agreement has been signed with Pemex, but Fish has set a goal of late 1960 to have the lines completed and deliveries started.

The company does not expect Long Island Lighting to be its only customer, but all the gas from South Texas and Mexico would go to the same New York metropolitan area.

In its contract with Transco, Fish has an escalation clause that permits it to hike deliveries to handle future contracts.

How Fish operates . . . The rapidly growing Fish organization in Houston has handled the new South Texas project in much the same way it has handled much bigger ones in the past.

Primarily a construction outfit, Fish figures that by developing projects itself it can keep crews busy and make money besides.

Currently Fish is preparing to start crews working in Argentina, where it is participating in the TIPSA project to build nearly 1,600 miles of pipeline at a cost of $180 million (OGJ, Sept. 8, p. 83).

Big Wage Hike Seen by 1963

ATLANTIC Refining Co. estimates oil-company wages will jump 22% before the end of 1963. More liberal fringe benefits will add another 2 to 5½%.

Figures are a "conservative projection of recent experience," according to Pres. Henderson Supplee.

To prevent soaring wages from eating up all profits, Supplee advised Texas Mid-Continent oil men in Dallas last week to: Share economic facts of life with workers and their representatives; keep other companies posted on wage negotiations; and educate the general public and political leaders.

While higher prices might help re-

cover extra wage costs. Supplee thinks they are unlikely. Improved economic conditions may protect the present crude-oil price level, "but for the foreseeable future don't count on making another boost stick," he warned.

First Atom Tanker

planned. Speedy submarine also in hopper for 1960.

CONGRESS will be asked next year to help finance the building of a privately owned atomic tanker.

And if cost studies show it to be commercially feasible, the Maritime Administration may start building a high-speed submarine tanker in 1960.

The Maritime Administration has been interested in submarine tankers for some time and has contracted for cost studies for ships ranging from 20,000 to 40,000 dwt., with speeds of 20 knots or more.

Several oil companies are interested in a surface nuclear tanker as a start, Administrator Clarence G. Morse said. A vessel of 35,000 to 45,000 dwt. is being studied, but details of cost, size, and speed have not yet been worked out.

Decision to go ahead with a surface vessel was based entirely on cost. A submarine tanker of 20,000 dwt. with a speed of 20 knots submerged would cost about $42 million. A similar conventional surface tanker could be built for $13 million to $14 million. A nuclear-powered surface tanker would cost somewhat more.

Submarine advantages . . . MA officials said submarine tankers, under proper conditions, have advantages which could become determining factors in the selection of the most suitable vessel for a given task.

A submarine tanker is much safer than surface vessels in case of war and is more efficient at high speed. A submersible tanker of 35 to 40 knots speed and high cargo capacity is a possibility. A surface tanker of equal speed and deadweight would be impractical, mostly because of the much larger power requirements. Underwater craft capable of extended navigation are also immune to weather conditions.

"The problem is, however, to make economic use of these advantages, since the cost of a 40-knot submarine tanker, although considerably less than that of a comparable surface ship, is nevertheless much too high to permit profitable transportation of liquid cargoes under present conditions," a Maritime Administration official explained.

Socony Plant Closed by Strike

. . . in New Jersey as independent union demands 20-cent hourly wage hike. Strike-bound Mandan plant reopens.

THE FIRST STRIKE in the 41-year history of the 87,000-bbl. Paulsboro, N.J., refinery of Socony Mobil Oil Co., Inc., kept the plant closed last week.

Two thousand members of the Independent Oil Workers Union walked out over demands for a 7½% wage increase. With existing average hourly rate at $2.73, the demand, if met, would mean an average pay boost of 20 cents per hour. The union is not affiliated with any other labor organization.

After 4½ days no talks had been held, and none were scheduled. The company said the present wage rate was as good as or better than at other refineries in the area.

Five hundred nonunion employes were continuing to cross picket lines to carry on supplementary duties. From 75 to 100 persons were sleeping in the plant, with food delivered from the outside.

Closing of Socony Mobil's 965-man laboratory next door to the refinery was imminent because of a lack of water, which normally comes from the plant.

Mandan on stream . . . Standard Oil Co. (Ind.) has reopened its Mandan, N. D., refinery despite a strike of the plant's operating engineers.

The strike began September 12 at the 3-year-old refinery. Reopening of the plant 2 weeks later with supervisory personnel from other company plants was condemned as "immoral" by the Central States Petroleum Union, which represents about 10,000 Indiana Standard employes.

The charge was termed "nonsense" by C. C. Buchler, manager of the company's Casper, Wyo., refinery.

"We are not submitting to an idea that a labor union possesses special privileges on moral grounds which should lead us to surrender the property rights of 155,000 stockholders," Buchler said.

Indiana Standard has filed a $350,000 civil damage action against the strikers, charging them with "scandalous and malicious conduct."

CSPU intervention in the dispute is regarded as significant since the striking operating engineers are members of an American Federation of Labor union, not the Standard employes' union.

Early NPC Agreement Sought

. . . by Interior Department. Seaton asks council to accept new government-control plan and set early meeting date.

THE National Petroleum Council is being urged by Interior Sec. Fred A. Seaton to accept proposed government controls so that it can quickly get back in business.

The NPC has not met in Washington since October 1957 because of a controversy over the Justice Department's demand that it be headed by a government chairman. That demand has now been watered down to provide for a cochairman, but a number of other questions have not been settled.

Many letters have been exchanged by Seaton and Hines Baker, executive vice president of Standard Oil Co. (N. J.) who is serving as chairman of the NPC negotiating committee.

The latest was written by Seaton last week, answering Baker's reminder that no agreement had been reached on such questions as agendas for committees and subcommittees.

Seaton, in effect, refused to make any concessions in the requirements for dual control, appointment of members, the keeping of minutes of meetings, and other matters.

Meeting urged . . . If the council accepts these, which "provide the degree of controls which the attorney general deems essential," other questions can be resolved later, he said.

"I consider it very important that the NPC be convened at an early date so that it may resume its role as an extremely important advisory group," Seaton wrote.

If the NPC accepts the major demands of the Government, Seaton said, he will be "open-minded" to further consideration of any remaining points of difference "in the event that actual experience demonstrates that further clarifications or modifications are necessary to assure that the council continues to be an effective advisory organization."

Bet on Multiple Completions to Grow

- Operators are losing their fear of cluttered holes. Technical gains end old headaches and make triples, even quadruples, very attractive. Problems remaining probably will give way with experience.

BACK of this trend toward multiple completions, you'll find:

. . . **Equipment** is now available to avoid former equipment failures and leaks.

New packers, christmas trees, wireline methods, muds, other down-hole tools have improved tremendously in recent years.

. . . **Regulatory policies** in the states, once a deterrent, have been revamped to recognize multiples.

. . . **Economics** is becoming the big factor.

Savings now possible with new tools plus high cost of drilling are forcing oil men to get the most possible production from every single well.

Tied to new oil . . . Production engineers generally agree that use of multiples is tied closely to the discovery trend.

There are exceptions, but the great bulk of triples will be installed in newly discovered fields. The reason simply is that older fields already have been drilled mostly to separate horizons.

One operator, for example, told the Journal:

"If we were to find a Seeligson field today, with its many closely spaced pays, we would certainly triple a great many wells.

"There are places in Seeligson where you can stand in one spot and almost touch three wellheads. But now that the money for these holes is long since spent, it would be silly to junk two of them and triple complete in the third."

Offshore lessons . . . That's why offshore fields offer such an attractive testing ground for multiple-completion advancement (see below).

But lessons learned and equipment and techniques proved offshore now are spreading at an increasing tempo to inland fields. So far this spread is confined mostly along the Gulf Coast where multizones are common. But another attractive area is West Texas.

In fact, Texas operators have shown a growing interest in multiple completions and particularly this year.

The first triple completion was accomplished in June 1956 by Amerada Petroleum Corp. at its 1 State "D" in Olivia field. Prior to that, dual completions were favored. In the next year and one-half only five more triples were completed.

But in the first 9 months of this year, Texas oil men have marked up 28 triples and the first quadruple. The first four-zone producer was Magnolia's Santa Crus Farms in San Carlos field, Hidalgo County.

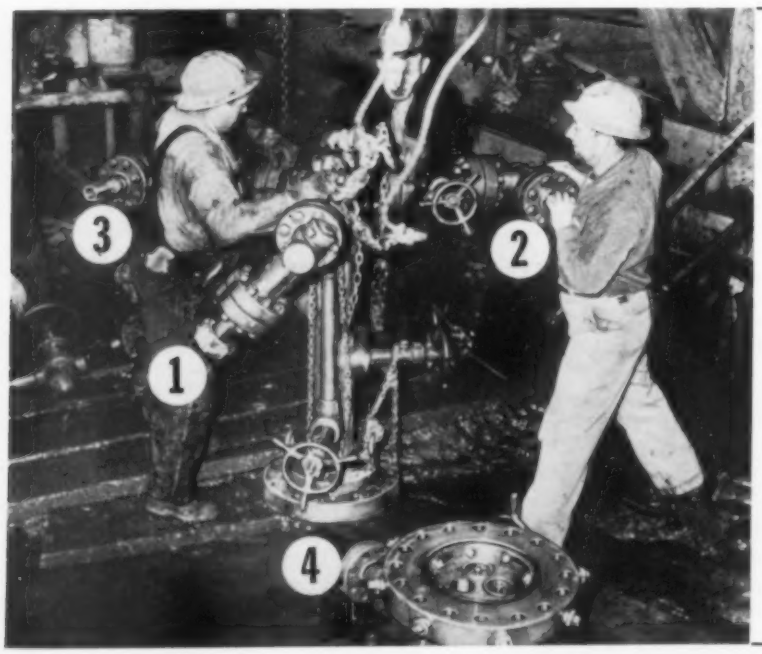
Of the new multiple completions, 13 are mixed gas and oil triplets, six all gas, and nine all oil.

The numbers aren't staggering but the increase in just 9 months appear significant.

The oil triples provide even more of a hint on what's to come. The Texas Railroad Commission has approved all of them in the last 3 months since it set a precedent by approving its first triple oiler in late June.

That first well was David and Inez G. Fasken's 2 Fee "J," which produces from the Wolfcamp, Devonian, and Ellenburger pays in the Fasken fields area of Andrews County.

Durable zones preferred . . . Ask any operator where triples are most applicable and his advice will be:



CREW assembles Magnolia's christmas tree at world's first four-zone well. Gas outlets are numbered.

Offshore: A

THE GULF tidelands area has led the way in multiple completions for two good reasons:

. . . **Production there** is new oil. It's thus easier and more economical initially to install the latest equipment.

. . . **Drilling** and production costs are extremely high. This forces operators to get as fast a return on investment as possible.

Operators who can't wait 15 or 20 or more years to deplete one or more

at Faster Tempo in Future

. . . Look first for reservoirs where producing-life expectancy is long.

. . . Closer the pays are together, the better. This holds down the pressure differential between zones. In extreme cases, big pressure drawdowns have sometimes unseated packers.

. . . Pays should have somewhere near the same producing life.

. . . Avoid "flash" reservoirs which produce well for a year then drop rapidly.

. . . Best bets are water-free oil zones or zones where producing sands aren't loose or unconsolidated. Sandy gas can blast holes in tubing and prove very pesky especially in mixed oil and gas multiples.

Obviously, however, operators don't often find onshore production that meets all these qualifications.

A free ride . . . The result is that often some very poor zones are included in triplets.

One engineer for a major operator explains you often have to triple complete to take in an ordinary-to-poor pay or abandon that pay because it could never stand on its own economic merit.

Actually, in practice, operators are going even farther than this. Very poor zones at medium depths are being produced in some Texas triples.

A case in point is a triple operated by Edwin B. and Edwin F. Cox, Dallas independent firm, in the Minnie Boch fields area of Nueces County. This well is producing from one gas and two oil pays.

One of the oil pays is a strong one with 20 ft. of good sand. The gas zone is fairly good, too. But the well is producing from a second oil pay with only a thin 4-ft. sand section. Half of its production, too, is water. This zone eventually will water out and be abandoned. But the triple here has served the cause of conservation. Without it, the weak zone would have been plugged off and forgotten.

The Cox firm, pleased with this first triple-completion experience, expects to do some more. Its Minnie Boch well produces oil through two strings of 1½-in. tubing and the gas through the casing-tubing annulus.

In its next ones, however, Cox likely will go to larger tubing, with eventual pumping of one or more zones in mind.

Pumping of one or even both zones in dual completions is not uncommon now. So far, however, no instance of pumping a single zone in a triple completion is on record.

Though operators shudder a bit at the prospect, most admit that pumping in triples is just around the corner.

A chief engineer for one major feels, however, that you can go only so far in this direction, now.

"You have a tough enough problem when the 'dog' (poor zone) of the three dies. But if you want something really interesting, try putting three dogs together," he observed.

Workover worry . . . Little experience is yet available in workover operations in triple or quadruple completions.

They're too new for that yet. Such experience, when it comes, will go far toward determining just how economic such multiples are. The workover question is the one that has caused many operators to hesitate.

As more and more modern workever techniques become available, however, this unknown becomes less worrisome.

Along with the uncontaminating muds, wire-line methods, corrosion inhibitors, and modern packers, have come other weapons to help the producer. Plastics, for instance, now can be squeezed into the face of a loose gas sand to consolidate it without shutting off the gas flow. This largely eliminates the danger of tubing leaks caused by the erosive effect of high-velocity sand in the gas stream.

Gas hydrates, once so troublesome in gas wells, can be eliminated fairly easily.

With such weapons at hand, a steadily growing number of producers are betting that they can handle the workover problems posed by multiple completions and still make them pay off.

Proving Ground for the Multiple Technique

zones, are virtually forced to multiple completions.

The CATC Group alone, for instance, now has 13 triple and one quadruple completions. The quadruple was the world's first well to flow oil from four separate sands out of four separate tubing strings (OGJ, June 30, p. 48).

Magnolia Petroleum Co., however, claims the first quadruple completion (photo) at its 8 Santa Crus Farms in San Carlos field of Hidalgo County, Texas. This well flows gas from three parallel tubing strings and from the casing annulus (OGJ, March 3, p. 81).

The swing to multiples is not confined to the CATC Group and Magnolia. Other early offshore operators also are investing heavily in them and the trend is certain to continue.

Other factors heighten the financial urgency offshore for multiple completions. For example, completing a multizone well there is more complicated than onshore and an operator might as well tap all the zones he can from one hole.

State regulations require operators offshore to fill the space behind each string of pipe with mud as a safety precaution. This helps keep the well under control if the wellhead should be damaged by storms.

In earlier jobs, operators found this mud settled around packers to such an extent that they couldn't be pulled. Research provided an answer, however. Engineers found they could use such chemicals as sodium nitrate in water in place of mud for the desired weight and safety.

These chemical solutions also had the advantage of inhibiting corrosion of casing.

Offshore fields also have been the proving ground for such other technical advances as the "selective dual" completion. This actually is a triple, but one in which only two zones are produced simultaneously.

A sliding-sleeve arrangement here blanks off a zone when it needs working over. At the same time it opens to production perforations in a second zone. The sleeve is tripped by a wire-line tool run from the surface. Such a switch, one tidelands operator says, can be made for less than $1,000.

A Look at California's Water-Flood Projects

Field; pool—	Year started	Type flood*	Water inj. in June '58 (B/D)	No. inject. wells	Avg. depth, ft.
San Joaquin Valley:					
Buena Vista, shallow	1954	P	2,000	4	3,200
Elk Hills, shallow	1957	F	6,800	2	3,000
Greeley, Vedder	1952	F-D	6,300	2	11,500
Rio Bravo, Vedder	1949	F	8,700	4	11,400
Russell Ranch, Diblee	1953	F	38,000	8	3,000
Rosedale Ranch, Stevens	1955	F-D	3,500	1	4,400
South Cuyama, Homan	1955	F	12,400	2	4,500
Tejon-Grapevine, S zone	1958	P	1,900	6	2,700
Other fields			12,800	25	
Area total			**92,000**	**42**	
Coastal area:					
Del Valle, Sherman	1946	F-D	3,000	1	6,000
Placerita, Juanita	1954	F-D	4,300	3	2,400
Shiells Canyon	1952	P	1,300	15	500
Casmalia, Sisquoc	1951	F	6,200	3	2,000
Orcutt, Zone 3	1950	F	4,000	6	4,000
West Cat Canyon	1954	P	5,300	8	2,400
Other fields			5,900	36	
Area total			**30,000**	**59**	
Los Angeles Basin:					
Dominguez, EC-1	1954	P	11,000	19	4,300
Dominguez, WC-5	1947	F	7,400	6	6,400
Inglewood, Vickers	1957	P	19,300	15	2,100
Richfield, Chapman	1957	P	6,800	4	4,300
West Coyote, Main	1956	F	15,100	4	4,000
West Coyote, "99"	1956	F	5,100	3	4,300
Wilmington, all pools		P-F	139,000	37	2,700 4,500
Other fields			8,300	6	
Area total			**212,000**	**94**	
STATE TOTAL			**334,000**	**195**	

*Type flood: F—flank or peripheral; P—pattern; D—water-disposal project, but some benefit may be gained in oil zone.

California Water Flooding on Upswing

• Secondary oil recovery to jump during next 2 years. Huge Wilmington field project, which is scheduled to become a 1,000,000-bbl. flood, is sparking the increase.

CALIFORNIA has trailed the rest of the nation in pressure maintenance and in secondary recovery—but that picture is due a drastic change.

Flooding on a pilot scale was not started in California until 1944, some 15 years after the method was in wide use in Pennsylvania and Mid-Continent fields. First full-scale pattern flood was started only 4 years ago.

Use of flooding has spread since then.

There are now 65 projects, double the number in operation 4 years ago. Twenty of these have water inputs of less than 500 bbl. daily. Water injection at the 45 larger projects totals 334,000 bbl. daily through 195 wells. The volume will approach 500,000 bbl. daily by the end of the year.

Clearer picture . . . Oil recoveries are a much more important criterion than the number of projects and volumes of water injected, however.

It is difficult to establish how much of the increase at any project is additional oil. But from information reported to the Journal, a half-dozen successful projects are yielding about 5,000 bbl. of water-flood oil daily.

These include those of Union Oil Co. and Shell Oil Co. in the Dominguez field, Union's project at Richfield, two by Standard Oil Co. of California at West Coyote, two floods in the Wilmington field, and Richfield Oil Corp.'s peripheral flood at Russell Ranch. Oil production at each has been stimulated to the extent of a "few hundred" to more than 1,500 bbl. daily. All but the Russell Ranch project are in semidepleted zones. Here's a rundown:

. . . Union and Shell broke precedent when they released detailed information on the success of their Dominguez first-zone project (OGJ, Sept. 22, p. 77). Oil production was down to 750 bbl. daily before the pattern flood

was started in July 1954. After peaking at about 3,000 bbl. daily, output is now down to about 1,400 bbl. More than 1,500,000 bbl. of additional oil already has been produced.

The two companies in November will start a second full-scale flood in the second zone of the same fault block. About 8,000 bbl. daily of water will be injected through 16 wells (surrounding 13 producers) in an irregular 5-spot pattern. Before the field is abandoned, Shell and Union plan to flood all eight zones.

... At Richfield, southeast of Los Angeles, Union has another successful flood under way. Water injection was started about a year ago at a 143-acre lease on the west edge of the field. Output had jumped from about 800 bbl. to more than 1,400 bbl. by last June and is still increasing.

Inability to carry out a cooperative or unitized project caused Union to use a crestal-type flood at the faulted, anticlinal structure. Flooding was initiated through four crestal wells close to the south lease line. As down-dip wells go to water they will be converted into injectors. A 7,000,000-bbl. increase in ultimate recovery is forecast.

... Two West Coyote projects are now more than earning their keep, California Standard reported earlier this year. Following pilot operations started in 1951, the company in 1956 started two full-scale peripheral floods. The two zones currently are taking about 20,000 bbl. of waste water daily, with seven injectors being used. Oil output is "several hundred barrels a day more" than was being produced.

At Inglewood, California Standard recently started a pattern flood after carrying out pilot tests for several years. In June a total of 19,300 bbl. of water was being injected through 15 input wells.

... The Russell Ranch project, conducted by unit-operator Richfield, has been slowly expanded until today it's receiving about 38,000 bbl. of water daily. Eight injectors are being used in carrying out the peripheral type project. Some injectors feed water into as many as eight sands, with the amount going into each being readily regulated.

Benefits realized from the 5-year old flood and from up-structure gas injection have not been released by Richfield. Production decline curves of the 3,000-ft. pool show a pronounced leveling off in the decline rate, however. The current oil output of 6,000 bbl. daily is some 700-bbl. above the old projected decline rate.

... Largest U. S. flood soon will be in the Long Beach Harbor area of the Wilmington field. Currently, 140,000 bbl. is being injected into upper zones. Before the year's end this will be stepped up to approximately 225,000 bbl. daily. Plans call for the amount to reach the 1,000,000-bbl. mark just as soon as unitization agreements can be worked out and facilities installed.

This project, involving some 2,600 wells with a current oil production of about 70,000 bbl. daily, is for the dual purpose of checking land subsidence and increasing oil recoveries. Faced with a federal court suit which would shut down the field if repressuring steps are not promptly taken, Wilmington operators are proceeding on a crash basis.

Small floods carried out by Long Beach Oil Development Co. and Union Pacific Railroad have shown that water flooding will increase oil recoveries and restore formation pressures. Whether surface subsidence will be checked is yet to be determined.

At the pattern flood operated by Union Pacific in the Tar and Ranger zones of fault-Block 3, about 12,000 bbl. of brine is injected through 13 wells. The company also is injecting about 5,000 bbl. daily at each of two peripheral projects in the Terminal zone in Blocks 2 and 3.

Other floods under way are in Blocks 4, 5, and 6, mostly on city of Long Beach properties operated by LBOD and Richfield. Some water is going into experimental pattern floods but the great bulk is being injected in south flank wells. A total of 105,000 bbl. daily is being injected in LBOD wells, 11,000 bbl. through Richfield wells, and 4,000 bbl. at a Ranger zone project of Producing Properties, Inc.

LBOD is completing a new 120,-000-bbl. plant on Pier A and a 70,000-bbl. plant on Pier E. Most of the brine from these plants is going into new injection wells completed in the aquafer of the Tar zone. Some of the wells are taking water at a 25,000-bbl. daily rate under a pressure of 500 to 700 psi.

Subsidence Action Taken

. . . as all of Wilmington field put in subsidence-control district. Mandatory unitization may result from move.

CALIFORNIA Oil and Gas Supervisor E. H. Musser last week exercised part of his new authority to order unitization in a subsiding oil field.

He included in a subsidence control district both the developed and undeveloped portions of Wilmington field.

Under the new law passed at the last session of the California legislature, Musser can order unitization immediately, with a repressuring program the goal. However, he has indicated he'll defer any such move right away as a number of voluntary unitization and repressuring programs are under way in the field.

If these voluntary programs bog down, then Musser can move in and order unitization within the boundaries he just established.

Only significant exclusions were: Monterey Oil Co.'s artificial offshore island operation of Seal Beach and a small portion of Fault Block I on the extreme northwest end of the field.

Musser outlined the subsiding area in a manner which includes virtually every operator in the field. The designated area includes:

. . . **The bulk** of the six producing fault blocks.

. . . **The 4-mile undeveloped** offshore portion of the field extending from downtown Long Beach to the Orange County line.

Musser's boundaries were established on the basis of two considerations:

. . . **Subsidence in areas adjacent** to the producing portion of the field is safety hazard for people living in the area and is damaging or threatening to damage surface and underground improvements.

. . . **Subsidence in the field itself** is threatening harbor facilities, interfering with commerce, navigation and fishing, and threatens to inundate large areas.

Sinking continues . . . Musser's action in setting the subsidence-district boundaries came on the heels of the latest subsidence report by the Long Beach Harbor Department.

In its annual subsidence report, the Harbor Department said:

. . . **The heart of the subsidence bowl** continues to be at approximately the location of the Southern California Edison Co. steam generation plant. Sinking there has hit 25 ft. and is continuing at the rate of 1.07 ft. per year.

. . . **Some areas adjoining Long** Beach Naval Shipyard show a subsidence of 23 ft. and a continuing sinking rate of just under 1 ft. per year.

. . . **The Long Beach City Hall area** shows a 3½-ft. subsidence and a yearly sinking rate of .2 ft.

Import Views Studied

. . . by Interior Department. Changes in program planned, though industry response has been lighter than expected.

THE NEW imports-control program will be put in final form probably in late November or early December.

Capt. M. V. Carson, Jr., administrator of the imports program, hopes to complete this month his review of suggestions received in the last 30 days for changes in the tentative program.

His recommendations then will go to the Cabinet fuels committee, which is expected to take final action within a month or so.

Some important changes are expected to be adopted before the plan to give quotas to all refiners is put into effect January 1. But officials decline to pinpoint the areas of modification before completing their current study of industry views.

Mostly critical . . . Few who have written to Carson have approved the proposed program as it stands.

But the only organized pressure for changes is being applied on behalf of the small refiners, in whose welfare the Justice Department, Small Business Administration and Senate small business committee have shown deep interest.

SBA officials say that they have received more than 60 letters from small refiners whose position under the program was explored in a meeting in Washington last month. This group, in general, endorses the program but urges that their quota level be raised.

The SBA will make a recommendation to Carson along this line, possibly suggesting that the small refiners be given a quota of 15% of capacity, to be available immediately at the start of the year.

But alternative methods may be offered to protect the competitive equities of the small refiners, demanded by the Justice Department.

The response to Carson's invitation to refiners and importers to submit their views has been lighter than expected. And for the most part, recommendations for improvement of the program have been limited to matters directly affecting the refiner who proposes them (see p. 59).

As expected, approval or disapproval of the plan as shown in the more than 100 letters received depended on whether the writers would benefit or lose under the new system. Most of the letters were from refiners, but some 30 or more came from individuals interested in the import problem.

Officials noted that little reaction had been shown in two areas. Refiners in the northern tier of states, dependent on Canadian oil, offered little comment, probably because they will be taken care of under the plan.

But only 3 or 4 comments were received from District 5, to which the program is expected to be extended next year.

Volume still high . . . The breakdown of the present program indicated by the upsurge of imports in August appears to be confirmed in preliminary reports for September now coming in to Carson's office.

August crude imports into Districts 1-4 averaged 56,200 bbl. daily more than the 713,000-bbl. allocation. Imports into District 5 were only 12,900 bbl. short of the allotment of 221,100 bbl. (OGJ, Oct. 6, p. 108).

Reports now reaching Washington indicate that the excess in September may have been fully as great in Districts 1-5 as in August, and possibly greater. Receipts into District 5 may have been right up to the allowable, if not above it.

Texas Shifts OIC

setup. Mid-Continent group will handle public relations.

TEXAS OIL LEADERS have changed signals as to how the state industry will handle its public-relations functions.

Last week, the executive committee of the Texas Mid-Continent Oil and Gas Association stamped its approval on a plan for Texas Mid-Continent to take over the Texas public-relations chores of the former Gulf-Southwest region of the American Petroleum Institute's Oil Information Committee.

With the executive committee's approving vote, the former OIC staff at Dallas and its functions were immediately absorbed by Texas Mid-Continent.

Plans for such a merger, though known for about 3 weeks, initially came as a surprise in that other arrangements with the appearance of permanence had been made. As of September 1, the Gulf-Southwest region of OIC was dissolved under the API's general public-relations decentralization program and the Texas area reconstituted as the Oil Information Committee of Texas (OGJ, Aug. 25, p. 41).

The OICT would have operated with a much larger budget furnished by Texas oil companies. Budget difficulties, informed sources say, were the principal reason for the last-minute change of plans, in that some of the largest contributors to the program felt it could be run more economically as a part of Texas Mid-Continent.

Under the new deal, former OIC staffers Jack Robinson and Earl Grabhorn will become staff members of Texas Mid-Continent. William T. Lynde, director of the Dallas OIC office since 1952, has resigned to enter private business.

Price Cuts Spread

for Oklahoma sweet crude. But many still hold line.

OKLAHOMA last week had a double price scale for its sweet crude after three other purchasers joined Sunray Mid-Continent Oil Co. in posting lower prices.

Sunray posted a price of $3.01 per bbl. for 40°-gravity and above compared with the old $3.15 top. A 2-cent gravity differential was maintained to 36° but the differential was cut to 3 cents for all gravities below that (OGJ, Oct. 6, p. 117).

Kerr-McGee Oil Industries, Inc., Champlin Oil & Refining Co., and Midland Cooperatives, Inc., lowered their postings to the scale set by Sunray. The four purchasers buy a total of 206,000 bbl. daily out of Oklahoma's 560,000 bbl. daily allowed production.

Other buyers reported they were delaying any price moves in Oklahoma pending detailed study of their position.

Sunray officials said the price cut was necessary to put Oklahoma sweet crude in a competitive position with other areas which all have been cut in recent months. The Oklahoma price change, if it sticks, could have repercussion in prices for oil in West and North Central Texas, the Panhandle, Kansas, and the Rockies.

In another price move last week, Humble Oil & Refining Co. cut its posted prices by 10 cents a barrel on 17,000 bbl. daily of Gulf Coast oil it buys. Humble called the move an adjustment to meet prices paid by other buyers in the fields.

THE LARK will compete on the road this fall as . . .

New Economy Car Is Unveiled

. . . by Studebaker. It's more powerful than the smaller imports but has less power than U. S.-made Rambler.

A SECOND U. S.-made economy car will try to cash in on the growing market for smaller, less-expensive automobiles.

Studebaker-Packard's new "Lark" will make its bow to dealers October 20 and to the public November 14.

It qualifies as an economy car both in initial cost and in operation and comes in two models: A six-cylinder, 90-hp., 8.3:1 compression-ratio engine and an eight-cylinder, 180-hp., 8.8:1 compression-ratio engine. Both will operate on regular-grade gasoline.

The Lark Six will be priced at "under $2,000." Its 90-hp. engine compares with 127 hp. for the only other U. S.-made economy car, the Rambler American. But the Lark is larger and more powerful than the popular imported cars. The Volkswagen has 36 hp.; Renault, 38; and Hillman Minx, 51.

Its 175-in. length compares with 191.15 for the Rambler, 163 for the Volks, 155.6 for Renault, and 160.5 for Minx.

The Lark Six and the Rambler American are expected to be close in price. Prices on the Rambler Six two-door sedan range from $1,821 on the "business" model to $1,920 on the "super," both factory delivered.

Year of decision . . . Studebaker-Packard's entry into the economy field may coincide with the year of decision for such cars.

They made up a good portion of the 1958 market. Imports sold 192,038 in the first 7 months. Rambler sales through the first 8 months were 109,288.

For the year as a whole, it looks as though they'll add up to nearly 500,000 vehicles—well over 10% of the 1958 U. S. market.

Only one Chrysler car, the Plymouth, and one Ford Motor Co. car, the Ford itself, has outsold the Rambler in 1958. Four General Motors cars outsold the Rambler: Chevrolet, Oldsmobile, Pontiac, and Buick.

The "big three" still think the American motorist wants size, power, and style. With the market expected to be closer to normal with 5,500,000 cars in 1959, the ultimate role of the economy car may be pretty well defined next year.

PIPELINE BRIEFS . . .

Transmission of gas from the Blueberry gas field in the Halfway area of northeastern British Columbia has started through Westcoast Transmission's new $7-million gathering system.

Three of 21 producing wells in the region were placed on stream for initial deliveries of 15,000,000 cu. ft. daily. Under agreement with the producers, Fargo Oils, General American Petroleums, and Gulf States Oil of Canada, deliveries will be stepped up to 50,000,000 cu. ft. by 1960.

Republic Oil & Refining of Texas City has acquired from Humble Pipe Line 48 miles of gathering lines in Refugio, Calhoun, and Victoria counties in South Texas. Republic will tie in the 6-in. lines with its trunk system to Port Lavaca terminal.

Carthage gathering system consisting of 86 miles of lines in Louisiana and Texas has been purchased by Scurlock Oil Co., Houston, from Gulf Refining. The lines extend from Odessa field, Caddo Parish, Louisiana to Gary, Tex., through Marion, Harrison, and Panola counties. System gathers about 7,500 bbl. daily from 15 fields.

Purchase of 51 miles of 5 to 8-in. trunk line and 75 miles of gathering lines in south central Oklahoma has been made by Kerr-McGee from Magnolia Pipe Line. It was the fourth gathering-system deal made by Kermac this year. It adds 3,000 bbl. daily in crude purchases in the Salt Creek, Wewoka, and Olympic areas.

Also for Pipeliners . . .

IN THE NEWS: Fish Engineering to sell South Texas and Mexican gas to the New York market (p. 72) . . . FPC examiner rules against Northern Natural (p. 84).

A complete list of pipeline construction projects appears in the last issue of each month. New projects are reported weekly in Pipeline Briefs.

PLUS THIS TECHNICAL REPORT: Products line crosses the Andes (p. 129).

CO_2 Puts Big Kick

. . . into water flood. Greater oil recovery obtained by water-driven carbon-dioxide bank than from water alone.

THESE SUCCESSES were achieved in tests of carbon-dioxide floods carried out with both high and low-viscosity crude by D. M. Beeson and G. D. Ortloff of Jersey Production Research Co., Tulsa.

Beeson and Ortloff outlined their results at the fall meeting of the Society of Petroleum Engineers of AIME in Houston.

The increase in oil recovery is explained by oil swelling and viscosity reduction, they reported.

As carbon dioxide is injected into an oil-bearing formation, it dissolves in the crude, reducing its viscosity. Water is then injected to propel the bank of CO_2 and oil saturated with CO_2, which in turn displaces the original oil.

In addition, the residual oil is highly swollen by the CO_2 in solution. At the end of the flood, then, the pore space in the formation is filled with this swollen oil. Thus, the amount of oil held in place, in terms of stock-tank oil, is less than if the residual oil were "dead."

When the model system which the authors used in their investigation was depressured at the end of the flood, some solution-gas-drive effect was noted. The saturated oil expanded just as gas-saturated oil expands, and additional recovery was obtained.

Results of the studies showed that recovery during carbon-dioxide-bank flooding can be closely predicted from phase behavior and water-flooding data.

Miscible flood mechanism . . . Mixing and dispersion in floods using solvents, such as propane and LPG, occur mainly by molecular diffusion, according to W. M. Terry, R. J. Blackwell, and J. R. Rayne of Humble Oil & Refining Co., Houston.

These men made studies both in sand-packed tubes and in reservoir models scaled properly to relate viscous, gravitational, and diffusional forces.

However, when dealing with viscous crude (high-mobility ratios), diffusion is not effective in preventing the formation and growth of fingers, even in homogeneous sands. At sufficiently low rates, channeling in tilted reservoirs is eliminated by gravity segregation.

In horizontal reservoirs, recovery at breakthrough decreases as oil viscosity increases. And volume of solvent or flooding agent required for complete recovery of oil also increases as oil viscosity increases. Permeability stratification decreases oil recovery below that for a homogeneous sand.

In reservoirs with adequate permeability and depth, gravity segregation can prevent channeling.

Chemicals cut corrosion . . . Corrosion in gas-lift wells can be drastically reduced by squeezing inhibitors into the producing formation, said Rupert H. Poetker, Sunray Mid-Continent Oil Co., Corpus Christi.

The success of this method is based on the fact that some inhibitors are rapidly absorbed by reservoir rock during the squeeze treatment and then desorbed relatively slowly as oil and gas are produced. When inhibitor is exhausted from the formation, the squeeze is carried out again.

In his studies, Poetker used commercial inhibitors dissolved in either oil or water, depending on the solubility characteristics of the chemical, and diluted to a concentration consistent with the nature and severity of the corrosion.

Scale deposits in oil wells can be minimized by injection of dimetallic polyphosphates into producing zones when fracturing. A. B. Featherston, R. G. Mihram, and A. B. Waters, Halliburton Oil Well Cementing Co., Duncan, Okla., reached this conclusion in reporting results of their corrosion-prevention investigations.

The inhibitor is introduced into fractures along with the fracturing sand. This provides the produced water for the very low concentration of polyphosphates, sufficient to prevent the growth of large crystals of carbonaceous material at the sand face or in the well bore.

The inhibitor is not corrosive and provides treatment for a long period of time.

Gas Turbines Will Make Bow

. . . in natural-gasoline plants soon. They will drive centrifugal compressors, lean-oil pumps, generators.

VERSATILE services of gas turbines in driving motors are only part of their future uses in processing plants.

Their hot exhaust gases can be generating steam, supplying heat to reboilers, or otherwise providing a source of process heat.

This picture of the combustion gas turbine, now available in sizes usable in gasoline plants, was presented last week at the California Natural Gasoline Association meeting. The speaker was C. R. Apitz of Clark Brothers Co., Olean, N.Y.

Use of gas turbines of about 1,250 hp. rating for such mechanical-drive applications can result in considerable savings in installation and maintenance costs, Apitz said. The economic advantage becomes even more pronounced when heat from the exhaust gases is utilized.

A new type packaged heater that can operate on turbine exhaust gases and can replace either boilers or direct-fed heaters as plant design dictates, plays an important role in the waste-heat utilization phase. The unit is competitive or lower in cost than conventional heater and boiler designs of comparable size, he declared.

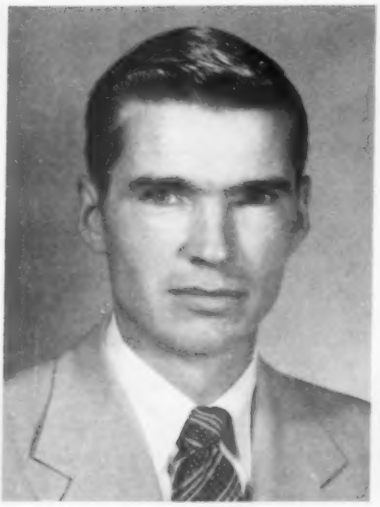
The unit can be equipped with auxiliary burners for temperature control or supplemental heat. It also can be designed to house heating coils for more than one service and control the temperature levels for each service. Design of the heater permits it to operate on extremely low pressure losses and does not impose pressure drops which would seriously derate the horsepower output of the gas turbine.

Concerning costs, Apitz said turbine-driven compressor units can be installed for $130 to $180 per horsepower. Gas turbine-driven centrifugal pump units will cost in the range of $130 to $150 per horsepower. In generator service, the installed cost will run about $175 to $190 per kw.

The installed cost of the turbine power-heat package, he said, "should be lower than practically any other installation that will provide the same flexible combination of mechanical power and process heat."

Complete application of gas turbines in gasoline plants will require much closer collaboration between the process and the mechanical equipment, Apitz said. This is due principally to the need for achieving a proper power-process heat balance.

Bertram F. Linz



Joe Reilly

Howard M. Wilson

Journal's Washington Editor Is Retiring

BERTRAM F. LINZ, for years staff editor of The Oil and Gas Journal in Washington and dean of oil writers in the nation's capital, will retire effective November 15.

Linz' retirement will necessitate new assignments for two Journal district editors:

Joe Reilly, the Journal's Gulf Coast editor, will move to Washington from Houston to succeed Linz.

Howard M. Wilson, Tulsa district editor, will transfer to Houston as new Gulf Coast editor.

Reilly is now in Washington working with Linz until his retirement. And Wilson has taken over his new assignment in the Houston office.

Linz is closing out a remarkable career that spans more than 40 years of business reporting in Washington. He has been the Journal's Washington editor since October 1947. Prior to that he had been chief of the Washington bureau of the New York Journal of Commerce and served as correspondent for other business publications.

Linz is considered one of the real veterans of the Washington scene. He is widely respected for his keen insight into the federal Government, its workings, and how they affect business.

Reilly joined the Journal staff in July 1954 and has been assigned in Houston for the last 3 years. He is a graduate of Notre Dame and worked as reporter and oil writer for the Wichita Falls, Tex., Daily Times and political writer for the Tulsa World before joining the Journal in Tulsa.

Wilson is a graduate of the University of Oklahoma and holds a master's degree in journalism from Columbia University, New York. He worked on newspapers in Oklahoma and for 10 years was political writer for the United Press in Oklahoma City. He joined the Journal's Tulsa staff in July 1957.

the **JOURNAL** *said.....*

50 *years ago*

October 20, 1908

The Oriental Steamship Co.'s tanker Soyo Maru cleared from the Gulf Refining Co.'s docks at Port Arthur, Tex., on October 6 with 41,722 bbl. of Glenn (Oklahoma) crude, consigned to the Nanboku Oil Refineries at Hiranuma, Yokohama, Japan. This is the first of several cargoes of Glenn crude which the Japanese refineries have contracted for, to be delivered by the Gulf people.

Two companies are proposing to supply the city of St. Louis with natural gas and there is hot rivalry between them. One company plans to get its gas from Kansas and the other from Oklahoma. There is a stringent law in Oklahoma against piping gas out of the state and Governor Haskell says he is going to enforce it to the letter.

25 *years ago*

October 12, 1933

Acid treatment of wells which produce from limestone formations has become common practice recently, particularly in the Mid-Continent area and Michigan fields.

The Rocky Mountain Association of Petroleum Geologists has petitioned the Federal Emergency Administration of Public Works for the allocation of public works funds to the U. S. Geological Survey in order that unemployed geologist may be employed on surveys of mineral resources in the Rocky Mountain region. The petition requests that $2,500,000 be set aside for this purpose.

10 *years ago*

October 14, 1948

Atlantic Refining Co. imported its first cargo of Venezuelan oil last week at its Fort Mifflin terminal outside of Philadelphia.

The U. S. District Court in Chicago has ruled that Universal Oil Products Co. is exempt from federal taxes because its earnings are devoted to scientific research and education in petroleum, hydrocarbon, and other related fields, and also go to universities as research grants.

Houdry Process Corp. has developed a new low-cost catalytic cracking process called Houdriflow, an improvement on the Thermofor catalytic process originally developed by Socony-Vacuum Oil Co., Inc.

Wider Spacing Urged

. . . at hearing on new Oklahoma field rules. Allowables based on acreage, depth advocated to reduce high costs.

OKLAHOMA Corporation Commission members heard from representatives of major oil companies last week that the high cost of Oklahoma oil is the reason it's being shoved out of its domestic markets.

Their suggestion: A new allowable plan regulating production according to size of spacing unit and depth of the well.

This would materially reduce the cost of production but would not reduce the amount of oil produced in the state, claimed James McGowan, attorney for Sinclair Oil & Gas Co.

McGowan's proposal found strong support from representatives of Phillips Petroleum Co., Magnolia Petroleum Co., Amerada Petroleum Corp., and Carter Oil Co.

"Oklahoma has lost its percentage of the domestic market because our oil costs more money," McGowan said. "When you drill two wells to get the same amount of oil, you just double the cost."

"This is a critical factor. If we drill fewer wells and produce the same amount of oil, we can reduce the cost and increase our market," McGowan added.

Formula submitted . . . Phillips and Magnolia submitted almost identical allocation tables based on acreage and depth. Other majors supported the proposal.

Based on the current Oklahoma minimum of 18 bbl. daily, the table gives a well up to 2,000 ft. deep 18 bbl. daily on 10-acre spacing, 36 on 20 acres, 72 on 40 and 144 on 80.

At 6-7,000-ft. depths, a well would get 40 bbl. daily on 10 acres, 70 on 20, 129 on 40, and 247 on 80. The 14-15,000-ft. well would get 145 on 10, 197 on 20, 298 on 40, and 502 on 80.

Phillips said this plan would encourage wider spacing in the shallower areas "where it is needed most."

Other ideas . . . Opposition to the acreage plan came from W. A. Delaney, Jr., Ada independent, who said he plans to submit a proposed rule to gear allowables to costs of drilling.

Delaney also urged the commission to adopt rules permitting proration of condensate wells and bringing these producers under the same regulations as oil wells.

He declared quotas should be fixed for wells which yield as much as 15 bbl. of condensate per million cubic feet of gas. At present Oklahoma has no controls over condensate production.

Numerous minor changes were suggested in sections dealing with general rules and drilling and development procedures. Most important was a suggestion by Phillips that wider spacing of wells in the early stages of pool development be provided.

Two cable-tool drilling contractors, O. O. Owen and George Martin, Tulsa, opposed the new plugging rules. They notified the commission they would request separate procedures for cable-tool operators.

More hearings . . . Chief interest at the hearings centered on the sections dealing with allowables and compulsory taking of allowables by purchasers.

The rules have been tentatively rewritten by the commission to make them reflect changed technology and conditions in the oil industry and to tighten enforcement (OGJ, Aug. 11, p. 72).

The commission has ordered all suggested changes in the proposals be submitted in writing by November 10. These will be considered before the final version of the new regulations are adopted. But before final adoption the commission plans further hearings this fall on the amendments.

New Oklahoma Allowable Plan Proposed

Here's the Oklahoma allowable formula suggested by Phillips Petroleum Co. The plan, based on acreage and depth, found favor with other major companies.

Av. depth of pool (ft.)	10-acre spacing	20-acre spacing	40-acre spacing	80-acre spacing
0-2,000	18	36	72	144
2-3,000	19	37	74	147
3-4,000	23	43	84	165
4-5,000	28	52	99	194
5-6,000	34	60	114	222
6-7,000	40	70	129	247
7-8,000	47	80	145	276
8-9,000	56	93	166	313
9-10,000	67	108	190	352
10-11,000	78	121	207	378
11-12,000	93	139	232	416
12-13,000	108	157	254	449
13-14,000	126	176	277	478
14-15,000	145	197	298	502

High Bids Made

for acreage in Texas near Terrell County gas play.

THE EXCITING new Terrell County exploratory area in West Texas hogged the show at the recent University of Texas land lease auction in Austin.

Cash bonuses for leases on 44,444 acres of university leases totaled $5,152,000.

Top bid was a giant $1,875,000 made jointly by Pure Oil Co. and Ohio Oil Co. for a 3,200-acre block in Terrell. The block is about 12 miles northwest of the recently opened multipay Brown-Bassett gas field (OGJ, Aug. 18, p. 106). The big bid figures out to roughly $586 an acre.

All told, Pure and Ohio, bidding jointly, paid nearly $2,500,000 for leases in the Brown-Bassett region.

The two companies must spud a 14,500-ft. wildcat on their newly acquired 3,200-acre tract within the next 6 months.

Despite the spirited Pure-Ohio bidding, the biggest per-acre bid was made by The Texas Co. for a 322-acre tract in the Triple "N" area of Andrews County. The company paid $450,000 for this acreage — about $1,400 an acre.

A second big drilling block, this one in Crockett County 2 miles north of a new gas strike, was picked up by Phillips Petroleum Co. for $200,000. This block takes in 1,280 acres and calls for an 8,000-ft. wildcat to be started in 6 months.

FOR-SALE sign is taken off two of these five rigs as . . .

Contractor Is Back in Business

. . . after 1-year shutdown. With no buyers for equipment, California firm foresees better future, will try again.

THE DRILLING BUSINESS in California was apparently in worse shape than Gene Reid Drilling Co. thought it was last year when the company put its five rigs on the market.

The company quit the business last October, sold its office and yard, moved the rigs to a new site in Bakersfield, and put them on display to attract prospective buyers. But there have been no takers.

Last week, the company announced it was going back in the drilling business. The original liquidation proceedings have been canceled and the company reorganized.

The firm, which is one of California's best-known contractors, will operate in the future as a two-rig outfit. Three of the rigs are still up for sale.

The board of directors felt that "conditions within the oil industry are improving and that normal operations in the foreseeable future can be anticipated."

In the face of mounting crude and stock surpluses, crude-price cuts, purchase-contract cancellations, and gasoline price wars in California these days, one oil-field wag was prompted to observe that what the Gene Reid directors really meant was that the industry couldn't get any worse.

New Starch May Aid Drilling

A NEW CORN PRODUCT, which may prove useful in oil-well drilling muds, has been developed by Agriculture Department researchers.

Cross-linked dicarboxyl starch, in fact, may find many uses—in paper, paints, textiles, food products, and cosmetics, as well as in drilling.

Department scientists explain that when ordinary corn starch is dissolved in water and boiled, the resulting paste jells upon cooling and cannot be poured.

A chemical process known as cross-linking retards water uptake and swelling. Additional chemical treatment makes the starch acidic and helps resist jelling. Combination with other materials produces a paste-like product that has extremely high viscosities but does not jell when cooled.

INDUSTRY BRIEFS . . .

About $80,000,000 for capital expansion will be raised by British American Oil Co., Ltd., through its offer of 2,000,000 shares of common stock. Gulf Oil Corp. will buy 1,156,200 shares, or about 57%. The rest will be offered publicly, with preference given to present shareholders.

The first bunkering terminal in the Western Hemisphere for offshore fueling is under construction in Freeport, Grand Bahama Island, the Bahamas. The terminal, designed by Ralph M. Parsons Co., Los Angeles, is being built by Marine Construction Co., Ltd., Freeport, for Freeport Bunkering Co., Ltd. It is slated for operation in January 1959. The tank subcontract has been let to Chicago Bridge & Iron Co. Gulf Oil Corp. has a 10-year contract to supply bunkering fuels and marine lubricants. The terminal will have a laboratory which will permit blending fuel to specific needs.

A 100-acre site north of Odessa, Tex., has been acquired by the Permian Basin Oil Show, Inc., for eventual construction of a permanent petroleum museum and exposition buildings. The land was presented to the Oil Show as a gift from Barrow Land Co. of Odessa. This year's show, scheduled October 16-19, will be held at the Ector County Coliseum and Fair Park grounds.

An electronic data processing department has been established by H. J. Gruy & Associates of Dallas, consulting petroleum and geological engineers. The expanded facilities of the new department, including an IBM 650 computer, provide complete data processing and programing of statistical studies, analyses, and predictions for the petroleum industry.

Oil properties in Texas, New Mexico, and Oklahoma have been sold back to R. Olsen of Oklahoma City in a deal reportedly involving $5,000,000. Olsen had sold the property in 1950 and 1951 to Graham Paige. Olsen bought back the property from a Graham Paige subsidiary, Royal American Corp. The deal involved about 6,837 net producing acres with 138 wells, plus about 2,872 net acres of proved but undeveloped land.

Warning on Automation Given

. . . process men at California Natural Gasoline meeting. Advice: Be sure units needed, then learn to use them.

REFINERS thinking of installing electronic computing and data-processing equipment for process control should profit from mistakes of many early users.

Dr. Joseph F. Manildi, general manager of Thompson-Ramo-Woolridge Products Co., said many expensive and complicated units have been installed without first knowing if they were really needed or how they should be used.

Manildi, one of the country's top process-computer authorities, gave his advice in a Los Angeles speech to the thirty-third annual meeting of the California Natural Gasoline Association.

"A computer should be installed for on-line process control only after a very careful technical and economic study, as well as a comparison of the various control methods, has been made," he said.

Manildi stressed that on-line computer control is not the only way to improve or optimize process operations.

"The very great advantages offered by computers can not be realized unless the entire computer system is efficiently applied to the right kind of task," he warned.

Four-year study . . . Thompson-Ramo-Woolridge showed in a 4-year study that the key to selecting the right process-control equipment depended on two factors: Complexity of the process and the rapidity of important changes in the processes, such as feed composition, flow rates, etc.

Manildi cited three distinct types of process-control problems, each requiring its own computer system. They are:

. . . **A simple process** not requiring minute-to-minute changes.

Operator can use a digital computer to work out all possible combinations of variables. Controller set-points can be adjusted by the operator after referring to the digital computer data.

. . . **Multi variable processes.** A constantly available offline computer can be used for the processes involving more than 20 or 30 controlled and uncontrolled variables but where significant changes in uncontrollable variables only occur over a matter of days.

. . . **Fast-changing conditions.** An on-line computer is necessary where the conditions vary rapidly. The on-line computer-control system is connected directly to process-measuring instruments and control devices.

It has a mathematical model of the process stored in the computer memory at all times and adjusts the controllable variables continually in the face of changes in uncontrollable variables.

Manildi said the 4-year study showed that most of the modern processes fall into the third category requiring on-line computer systems for optimum benefit.

When properly used, a process-control system can pay out in 6 months to 2 years in higher throughputs, higher yields, lower operating costs, less quality-give-away, and lower rejection rates.

Computer-control systems now being developed and studied will permit refiners to use, on a full scale, research processes now considered impractical to control, he added.

Elk Hills Oil Swap Proposed

STANDARD Oil Co. of California has offered the Navy a deal for Elk Hills royalty oil formerly taken by independent contractors.

California Standard, in the only proposal received in response to a Navy invitation, offered 4,035,000 bbl. of Navy special fuel oil for the 3,000,000 bbl. of crude offered from Naval Petroleum Reserve No. 1.

The Navy has been getting $2.36 a barrel for Elk Hills royalty oil and paying about $1.80 per barrel for fuel oil. On the face of it, the department would trade $7,080,000 worth of crude for $7,263,000 worth of Navy special.

Examiner Says No

to Northern Natural's bid to serve new gas markets.

REJECTION of Northern Natural Gas Co.'s applications to serve Minnesota and Wisconsin markets which Midwestern Gas Transmission Co. proposes to service was recommended last week by a Federal Power Commission examiner.

Examiner Francis L. Hall ruled in a report to the FPC that Northern had failed to show that its proposed facilities are capable of making the sales to these new markets and that its gas supply is inadequate for that purpose.

Hall recommended, however, that the temporary permit held by Northern to build facilities costing $11,750,000 and providing additional daily capacity of 75 million cubic feet be made permanent. This was part of

PROCESSING BRIEFS . . .

The first plant for Shell Chemical Corp. on the East Coast will be built on a 180-acre tract in New Jersey across the Delaware River from Philadelphia. Shell Chemical will build a synthetic resin and plastic plant on the acreage purchased from Swarthmore College. Construction date hasn't been set.

First delivery of Western Canadian crude to a new 20,000-bbl. Cities Service Oil Co. refinery at Bronte, Ontario, was made last week. Crude entered the tank farm through a 2¼-mile delivery line connected with the 156-mile, Sarnia-Port Credit extension of Interprovincial Pipe Line. The refinery is scheduled to go on stream soon.

A unique steam power plant has been completed by Tidewater at its Avon refinery in California. The new plant is designed to burn any of three types of fuel—fuel oil, refinery gas, or fluid coke, or any combination of the three simultaneously.

The unit can make 500,000 lb. per hour of 1,250 psi. steam at 950° F. Up to 500 tons of fluid coke daily can be supplied to the plant by being blown through a 1,500-ft., 10-in. pipeline from the nearby fluid coker. The new unit is the last in a 3-year expansion program.

More asphalt capacity will result from Imperial Oil's $425,000 expansion program at Halifax, N. S. Scheduled to go on stream next spring, the new facilities will turn out a full line of paving and roofing asphalts. New blending units are being added, and oxidizing equipment is being modernized.

Construction contract to build alkylation and isomerization plants at the Richmond, Calif., refinery of Stand-

an over-all project to cost $65,493,000 by which Northern planned to increase its capacity to 149.5 million cubic feet and serve 73 new communities.

Northern planned to get 75 million cubic feet daily of the additional gas from Permian Basin Pipeline Co., a subsidiary. Another 50 million cubic feet would be drawn from Redfield storage, and 24.5 million cubic feet would be taken from its own reserves.

Hall noted that the Permian project had been temporarily authorized and the Redfield storage project was denied in a previous decision. The supply from Northern's reserves in the Hugoton field was "overstated," he said.

The decision was the sixth filed by Hall in the Midwestern case. Thirteen of the twenty applications involved have been dealt with. But no further decisions will be filed, he said, in view of the speeding up of the case by the FPC, which is to hear final arguments this week (OGJ, Oct. 6, p. 120).

Hall's previous decisions denied applications by Natural Gas Pipeline Co. of America and Michigan-Wisconsin Pipe Line Co., also seeking to serve the big Midwest market.

No ruling has been made, however, on the applications of Midwestern Gas Transmission Co. to import up to 204 million cubic feet of gas daily from Canada and purchase another 204 million cubic feet from Tennessee Gas Transmission Co. at Portland, Tenn.

CHECKING a wide-base platform model are R. G. LeTourneau, center, and engineers Sherman Barber and W. G. Roberds.

Angled Legs Make a Sturdy Platform

CONSTRUCTION of a wide-base offshore platform with angled legs is being considered by R. G. LeTourneau, Inc., Longview, Tex.

The company has designed a working model of the new type platform. R. L. LeTourneau, vice president, indicated the company will build one of the structures later this year. He says the angled legs provide greater platform stability and operational flexibility than any other design. LeTourneau has previously stated that angled legs would permit drilling in water ranging from 100 to 600 ft. deep.

ard of California, has been awarded Fluor Corp. A 55,000-bbl. fluid catalytic cracking plant already is under construction at the refinery. Completion of the three plants is scheduled next spring.

A new gasoline for 1959 cars is being introduced by Socony Mobil. It is designed for the leaner carburetor settings and more delicate ignition adjustments of the new models seeking higher economy. The sales campaign will be based on road performance tests in the new cars.

Acquisition of a substantial interest in Hempstead Oil & Storage Co., Inc., of Mobile, by Murphy Corp., El Dorado, Ark., has been approved by stockholders of the two firms.

Murphy, primarily crude producer, recently purchased Lake Superior Refining Co., Superior, Wis. Hempstead has been in the wholesale gasoline and petroleum products business in the Mobile area for more than 30 years.

Nation-wide gasoline quality, unchanged for months, moved up in September. Ethyl Corp.'s monthly survey shows premium at 98.6 RON, one-tenth above August and the first improvement since a like increase last February. Regular was up to 91.4 RON, two-tenths above the August average and the first gain since a one-tenth improvement last May.

Refinery acid sludge recovery by the Miley process is being adopted abroad. Norddeutsche Affinerie of Hamburg, Germany, is licensing the process which originated at the L. Sonneborn Sons refinery in Petrolia, Pa. Sludge is continuously contacted with hot recycled coke and converted to additional coke and sulfur dioxide.

A test manual on plant operations, a collection of more than 80 test methods used in the control of gas-processing plants, has been published by the Natural Gasoline Association of America. Designed for plant laboratory use, the manual was compiled by the association's plant control committee, headed by K. G. Bottenberg, Phillips Petroleum, Bartlesville.

Also for Refiners . . .

IN THE NEWS: A strike by an independent union demanding a 20-cent hourly wage increase has closed Socony's big Paulsboro, N. J., refinery (p. 73) . . . Carson plans to put his new imports-control program into final form by November (p. 78) . . . Gas turbines are expected to gain a greater role in processing plants both for driving motors and for supplying process heat (p. 80) . . . Expert warns refiners to go slow on automation. His advice: Be sure you need the costly equipment and then learn to use it first (p. 84).

PLUS THESE TECHNICAL REPORTS: Special data-logging section (pp. 91-109) . . . New two-way process sweetens gas, recovers sulfur (p. 120).

Nasser Nullifies Syrian Concessions

• Hope of American oil development in Syria is dealt paralyzing blow.

THREE YEARS ago a Syrian-born Illinois drilling contractor went back to the land of his ancestors, wrangled a concession over 6,000 sq. miles, and a little more than a year later brought in Syria's first oil discovery.

With his first test obviously a commercial well, in spite of its remote location, it wasn't too difficult for the independent to find partners in Atlantic Refining Co. and Cyrus Eaton's Portsmouth Steel Co. Then three more wells each good for 500 to 700 bbl. daily were completed in the new field.

Last week the contractor and his partners learned they've been "Nasserized." The United Arab Republic announced coldly in Cairo that the concession had been "annulled."

The Illinois contractor, J. W. MenHall, got the news while en route to Syria from his Benton, Ill., home.

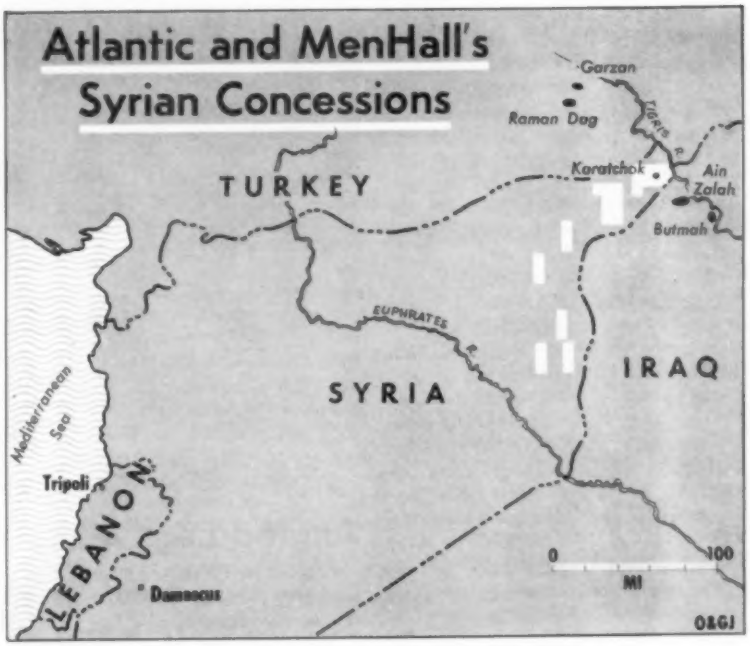
Atlantic officials cautiously waited for some official word from the joint Syrian-Egyptian Government at Cairo before saying anything. No one was quite certain what had happened, but it sounded ominous.

Violations charged . . . News reports from Damascus last week said simply that the U.A.R. Government cancelled the drilling concession because of "violations" and added that MenHall had failed to file requested "expenditure reports."

The Damascus reports said the action was taken by President Gamal Abdel Nasser and the U.A.R.'s Syrian Minister of Economy and Commerce, Khalil Kallas.

In a companion action, the government banned all future activity of Syrian Arabian Oil Co. This company was formed by MenHall in 1955 to finance his operation after MenHall Prospecting & Exploitation Co. was granted drilling rights over 11 separate tracts totaling 770,000 acres. He sold 95% of the stock in SAOC to 8,000 private stockholders living in Syria.

The action came just a week after Nasser's Cairo Government set up a new General Petroleum Authority to control every phase of the oil business in both Syria and Egypt.



Oil needed . . . If the government's action in canceling the concession is final, it is doubly ironic.

Syria, one of the most poverty-ridden of all the countries in the Arab orbit, has no oil. The country has little else on which to base a sound economy.

MenHall made his discovery in a region where the mammoth Iraq Petroleum Co., Ltd., spent $17 million drilling 11 tests without a commercial discovery. IPC pulled out of the area later drilled by MenHall in 1951. The big company left Syria entirely in 1954 (OGJ, Nov. 5, 1956, p. 85).

In spite of the fact that MenHall literally put Syria on the world's oil map, he was never able to persuade the Syrian Government to grant him a development concession. The Illinois independent and Atlantic Refining have been negotiating with the government in recent months in an effort to get the exploration permit converted to a development concession.

The Nasser action aroused speculation that the government may plan to take over the field at Karatchok and attempt to develop it.

Hassam Jebara, Syrian planning minister, said flatly several months ago that no more private concessions would be granted in the country. He said the government would carry out any further search for oil with Russian personnel and equipment (OGJ, May 5, p. 83).

The only other private company now at work in Syria is Ste. des Petroles Concordia, a West German company controlled by Deutsche Erdoel, A.G. The Concordia firm is drilling a deep test about 75 miles southwest of Karatchok.

MenHall field . . . The Syrian discovery came in the fall of 1956 on a large east-west anticline in extreme northeastern Syria.

The discovery is only about 20 miles from Ain Zalah field in Iraq and about 10 miles from the Turkish-Iraqi-Syrian border. The 22°-gravity asphaltic crude was found in a fractured limestone pay of Upper Cretaceous age topped at about 6,000 ft.

None of the wells drilled went through the entire limestone pay, but about 200 ft. of the zone was penetrated in each test. The wells were drilled in an east-west trend along the structure about 2 kms. (1.2 miles) apart.

African Activity Picks Up

. . . with entry of Socony affiliates and Shell in SPAEF's concessions. Four wildcats are drilling in two blocks.

EXPLORATION is already under way on acreage acquired in French Equatorial Africa by affiliates of Socony Mobil Oil Co., Inc.

The French company, Ste. des Petroles d'Afrique Equatoriale Francaise (SPAEF), is the operator under the agreement with Mobil Oil Francaise and Mobil Exploration West Africa, Inc. Expenses and any production will be shared 50% by SPAEF, and 25% by each of the two Socony companies (OGJ, Oct. 6, p. 123).

Socony is one of the two major companies which has acquired an interest in parts of the SPAEF concession over Gabon and Middle Congo. The other newcomer is Royal Dutch-Shell.

SPAEF has four wildcats drilling ahead in the northernmost of the two Socony blocks. This acreage rings the Port Gentil area, which the French company has retained for itself. Commercial crude production around Fort Gentil has grown to more than 9,000 bbl. daily from Pointe Clairette, Ozouri, and M'Bega fields.

SPAEF also has retained acreage around its Pointe Indienne discovery in the Middle Congo. One rig is drilling stepouts from the 105-bbl.-per-hour discovery and another is wildcatting in the vicinity.

Socony is participating in rights on about 6,175,000 acres in Gabon and Middle Congo, including all offshore areas held by SPAEF. Socony will be the operator if offshore work is begun.

The Royal Dutch-Shell joint agreement covers 4,700 sq. km. (about 1,160,000 acres) in Gabon. The area lies 93 miles south of Port Gentil, just south of Socony's northern block.

Other activity in that area includes the spudding of the first wildcat in the West African enclave of Cabinda by Cabinda Gulf Oil Co. The tiny territory lies wedged between Belgium Congo and French Equatorial Africa.

Venezuelan Crudes Are Cut

CIA. SHELL de Venezuela last week sliced the prices of 15 of its heavier Venezuelan crudes with cuts of 25 cents a barrel for five of the heaviest.

Richmond Exploration Co., a subsidiary of Standard Oil Co. of California, reduced its price for Boscan crude in Venezuela by 15 cents a barrel.

The Shell company left the posted prices for all its crudes of 25°-gravity and above untouched. Included in those cut 10 cents a barrel were Leona, Orocual, two Cabimas crudes, Temblador, and Tia Juana Veinte. Cut 15 cents were Merey, Taparito, Mara Pesado, Boscan, and Lagunillas.

The 25-cent decreases were posted for Bachaquero, Tia Juana Trece, Tia Juana Doce, Laguna Once.

Creole Petroleum Corp. recently cut its price 15 cents a barrel for heavier Venezuelan crudes.

Solid Fuel Useful

to geologists and hunters, according to the Russians.

RUSSIA is hailing mass production of "solid petrol" as a new, highly practical achievement of Soviet science.

In sizes ranging from tiny cylinders to briquettes and large blocks, the packaged liquid fuel consists of gasoline trapped and protected from evaporation in hardened plastic-film honeycombs. The Russians say when a block is pressed and the cells crushed, pure gasoline flow out.

They add that the blocks of solid petrol can be ignited with a match and burn easily with a steady flame. They can be extinguished and relighted.

The USSR Academy of Sciences' Mineral Fuels Institute developed the process. The academy says the liquid fuel is mixed with a tank of a plastic material which they do not identify. The resulting emulsion is then combined with a solidifier. After the resulting thick "petrol paste" is allowed to dry, it is cut into blocks containing "95% gasoline."

The Russians say polar explorers, geologists, mountaineers, and hunters are using the new fuel form.

Another Monagas Well Dry

PAN VENEZUELAN Oil Co. has abandoned a second disappointing duster on a Southern Monagas concession tract for which the company paid more than $15 million in bonuses last year.

Pan Venezuelan has abandoned its Mona-28-2 at 9,029 ft. on Block 28. The first test of the tract was abandoned at 7,919 ft.

The company's luck has been better on Block 11 to the south. There Pan Venezuelan has five heavy gravity producers offsetting Creole Petroleum's Jobo field (OGJ, June 2, p. 87).

How Many Rigs Are Running and Where

	Oct. '58	July '58	July '57
Latin America:			
Argentina	55	55	58
Bahamas	1	1	..
Barbados	1	1	..
Bolivia	16	16	10
Brazil	30	30	20
British Honduras	1	2	
Chile	4	4	5
Colombia	22	17	20
Costa Rica	..	..	1
Cuba	3	2	7
Dominican Republic	1	1	..
Ecuador	3	4	7
Guatemala	1	1	
Jamaica	..	..	1
Mexico	110	110	96
Nicaragua	..	..	1
Panama	1	1	..
Peru	13	13	16
Trinidad	33	27	28
Venezuela	95	93	137
Total	400	388	407
Western Europe:			
Austria	32	32	32
Denmark	1	1	..
France	50	50	29
West Germany	140	140	136
Greece	..	..	1
Italy	36	36	34
Malta	1	..	..
Netherlands	3	3	9
Portugal	1	1	2
Spain	3	3	3
United Kingdom	4	6	8
Total	271	272	254
Middle East:			
Bahrain	1	1	1
Iran	8	8	8
Iraq	8	8	5
Israel	6	6	12
Jordan	1	1	1
Kuwait	6	6	5
Neutral Zone	5	5	6
Qatar	1	1	1
Saudi Arabia	3	3	4
Southern Arabia	3	4	4
Syria	2	2	1
Turkey	5	5	5
Total	49	50	53
Asia-Pacific:			
Australia	4	4	5
British Borneo	2	2	3
Burma	3	3	2
India	5	5	6
Indonesia	16	16	21
Japan	15	15	15
New Guinea (inc. Papua)	1	3	4
Pakistan	6	6	8
Philippines	1	1	2
Total	53	55	66
Africa:			
Algeria	37	37	24
Angola	2	2	2
British Somaliland	..	1	1
Egypt	5	4	2
Fr. Equatorial Africa	10	10	10
French West Africa	3	2	1
Ghana	..	..	1
Libya	8	7	2
Madagascar	3	3	2
Morocco	2	2	4
Mozambique	..	..	1
Nigeria	6	6	6
Somalia	2	2	2
Tanganyika	1	1	1
Tunisia	2	2	2
Total	81	79	61
GRAND TOTAL	854	844	841

Note: Data in some cases estimated where completely up-to-date reports are lacking.

Foreign Drilling Hitting Record Clip

- Industry slump fails to cut down on number of rigs running abroad.

A JOURNAL SURVEY shows 854 rotary rigs operating in the free world outside the U. S. and Canada.

This is up slightly from summer and from last year. Of the three postwar recessions, 1949, 1954, and the present, this is the first time that foreign rigs are busier coming out of a slump than going in.

The total covers rigs drilling wildcat and field development wells. Rigs assigned to workovers and service are not included. Rigs in the U. S. and Canada still are nowhere near last year's level. Late in September there were 1,909 rigs making hole domestically, and 150 were running north of the border.

African play . . . More wildcats are under way in Africa than in any other foreign area.

Continued French enthusiasm for oil development in its overseas territories is largely responsible. As many rigs as ever are looking for more Hassi Messaoud fields in the Sahara.

The first American group to drill a well in French Africa is Plymouth Oil Co. and Benedum-Trees Oil Co. A 13,000-ft. test is getting started on the Ivory Coast. Two other programs are in progress in other sections of French West Africa. British Petroleum Co., Ltd., is partner in a wildcat in Senegal. A French company is working in the vicinity of Dakar.

Libya has eight wildcats under way. Every major international company and the Conorada group of American companies has an interest in at least one of the wells.

East Africa still is one of the world's least known prospective areas despite years of deep and expensive wildcatting along the coastal fringe. One more rig will enter the active list soon when it arrives in British Somaliland from Houston. Standard-Vacuum Oil Co. will use it initially on a test at Dagah Shabell, due to be spudded December 1.

Egypt is the exception in Africa. All five rigs in operation are on development work in fields operated by International Egyptian Oil Co., controlled by Petrofina and the Italian agency, ENI. Four outfits are drilling in Belayim field. The fifth is drilling in Rudeis. There are no other drilling operations in the country.

Middle East . . . As usual, the number of rigs making hole in the Persian Gulf area is not a clue to the importance of the region.

The largest producer, Kuwait, has only six rotaries in operation. Three are in the northeast, two at Raudhatain, and one at Sabriya. Three others are running in the Burgan and Magwa-Ahmadi areas.

A lot of drilling is due in the Persian Gulf. But for the present, only

two wells are under way. One is the Umm Shaif discovery, drilled by British Petroleum and Cie. Francaise des Petroles 20 miles off Das Island. The other is Manifa 2 being drilled off Saudi Arabia by Arabian American Oil Co.

Aramco has two rigs on development drilling on land. They are at Khurais and Khursaniyah. Two more rigs are drilling gas injection wells in the Ain-Dar area of Ghawar field. There are no wildcats.

Latin America . . . Venezuelan drilling continues to be off from last year.

There are about 95 rigs running, with 19 of them on exploration work. Activity in Colombia has gained slightly, with 10 rigs drilling wildcats, and a dozen on field development.

Exploration play is comparatively slow in some Latin areas. There is only one rig on wildcat tests in Peru and Ecuador. Cuba has three rotaries in operation, compared with seven a year ago.

Production Climbs

for Maracaibo newcomers, Superior and San Jacinto.

TWO OF LAKE Maracaibo's fledgling companies are rapidly working themselves into the class of sizable Venezuela oil producers.

Superior Oil Co., which paid a record $2,831 an acre for a 7,774-acre block in the middle of the lake 2 years ago, produced an average of more than 47,000 bbl. daily the last week of September. The company is expected to push this above 53,000 bbl. daily during October.

Another Venezuela newcomer, San Jacinto Venezolano, C. A., expects to be able to move 50,000 bbl. daily from Marlago field as soon as it completes facilities which are now being built. San Jacinto already has 190,000 bbl. storage at San Lorenzo, adjacent to Shell's terminal, and is building another 250,000 bbl. in tankage. As soon as the new storage, flow lines, and dredging is completed, the company will be ready to step up production.

Marlago field is on a 2,000-acre tract of national reserve acreage on the eastern edge of the lake which was acquired by San Jacinto and a group of partners including Tennessee Gas Transmission, Union Oil, Murphy Corp., Monsanto Chemical, American Petrofina, and Sharples Oil.

Neither Superior nor San Jacinto operated in Venezuela until the country started granting new concessions 2 years ago.

Philippine Hopes Rise

. . . with completion of small gas producer in the Cagayan valley in northern Luzon. Stepout locations are sought.

FIRST BLOOD in Philippine exploration play has been drawn by Standard-Vacuum Oil Co. Stanvac has completed its Ipil 1 wildcat as a small gas producer.

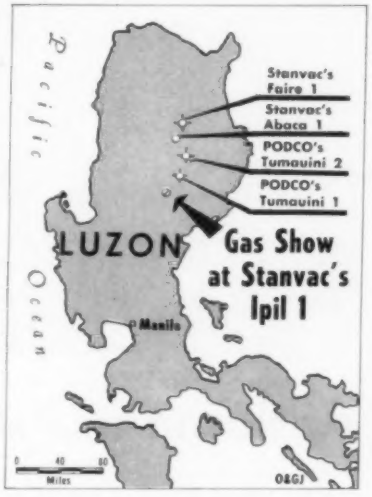
The well is 200 miles north of Manila on the southernmost of Stanvac's two blocks. It is the company's second test, and the fourth well drilled in Cagayan valley.

The gas was encountered in a 20-ft. section of Miocene limestone from 4,350-70 ft. Total depth of Ipil 1 is 7,260 ft.

Total of 71,936,000 cu. ft. of "very dry gas of high methane content" was flared, mostly in a 1-in. choke, on a 10-day deliverability test. Stanvac said the indicated flow of 7,000,000 cu. ft. daily warrants further study of gas reserves in the area.

The company commented that the flow was not commercial, especially in view of the remote location of the well. The reservoir would have to extend over a large area to make commercial development feasible. Tests indicated the formation has low permeability and porosity.

Stanvac will start seismic work in the Ipil-Echague area soon to provide locations for stepouts from the discovery. The rig has already been moved 60 miles north, where it has started drilling Abaca 1.



The Abaca wildcat is 6 miles south of Tuguegarao on Stanvac's northern block. It is about 25 miles south and slightly east of Faire, where the company drilled a duster last year. Two Tumauini deep tests, abandoned by Philippine Oil Development Co. (PODCO), are about 25 miles south of the new well (OGJ, Sept. 1, p. 120).

Algeria-Tunisia Line Nearer

. . . as French discuss contract with Bechtel Corp., of San Francisco. It will be North Africa's second big pipeline.

FINAL DETAILS of a contract for the 24-in., 470-mile pipeline to link Algeria's three fields in the Edjele area with the Tunisian Mediterranean coast should be worked out before the end of the month.

Diplomatic agreements to allow the line to cross international boundaries were pretty well cleared up 2 months ago (OGJ, Aug. 18, p. 122).

The concession contract is expected to be let by the transportation subsidiary of Cie. de Recherches et Exploitation de Petrole au Sahara, developer of three fields which are now shut in. Royal Dutch-Shell owns 35% of CREPS with the remaining interest in French control.

Southern terminus of the line will be at Amenas, north of Edjele field and near the newer and more promising Zarzaitine field.

From there the line would move north along the Libyan-Algerian border to southern apex of Tunisia where it would cross the boundary and move almost due north to El Shkirra on the Gulf of Gabes.

The French hope to have at least 40,000 bbl. daily of the high-gravity crude moving through the line by early 1960 and eventually boost the flow to more than 250,000 bbl. daily as the fields are more fully developed. CREPS has four rigs developing shallow fields.

Work is already under way on North Africa's first 24-in. crude line from Hassi Messaoud field to Bougie on the Algerian coast.

Anticline in Pakistan Finally Gets Test

SOME PROMISING structures get a quick test. With others it takes a little longer.

The rig shown here is testing a structure at Mazarani, 48 miles west of Larkana in West Pakistan. Spudded recently with a diesel-powered National 75 rig, the well is drilling below 2,200 ft. in a region that has never been tested.

The Mazarani anticline first attracted the attention of oil geologists almost 80 years ago. It was almost 20 years ago when Burmah Oil Co.'s geologists carried out the first aerial reconnaissance of the area and first photographed the structure from the air. Two years ago, geologists with Pakistan Petroleum, Ltd., a BOC affiliate, completed ground surveys and mapping in the area.

The well spudded recently is expected to test sedimentary beds to at least 11,000 ft. The site is the south bank of the Khinji River in a narrow valley about 300 ft. above sea level. The rig is surrounded on all sides by low hills.

The location is about 145 miles due north of Karachi and about 120 miles southwest of Pakistan's Sui natural-gas field.

About 70 miles south and slightly to the east of the Mazarani test, Hunt International Petroleum plans to spud a test on a PPL concession at Badhra next month. The two companies plan joint development of a find at either location.

WORLD BRIEFS . . .

A 32,000-bbl. Hawaiian refinery will rise soon at Barbers Point, 16 miles west of Honolulu. Standard of California will break ground October 24. First units will be in operation by the end of 1960. Contractors on the job are Hawaiian Dredge Co., Bechtel Corp., and E. E. Black.

An option on a 225,000-acre concession in Panama has been acquired by Texas American Oil Corp., of Midland. The acreage, held by a former vice president of Panama, offsets a concession on which Champlin Oil & Refining Co. is drilling a deep test for itself, Kerr-McGee Oil Industries, and Southland Royalty Co. (OGJ, July 14, p. 88).

Mediterranean deliveries of Saudi Arabian crude were a record-breaking 449,554 bbl. daily in September. Trans-Arabian Pipe Line Co. figures showed shipment from Sidon, Lebanon, during the month exceeded the previous high by more than 55,000 bbl. daily.

Location for a deep New Zealand test has been staked 11 miles from Hawera on the west coast of North Island. Shell-B.P.-Todd Oil Services expect to start drilling early next year.

A 10-mile, 10-in. natural-gas line will be built by Japan Gas Chemical Industries from its company-owned fields to plants in Niigata, Japan. The line will deliver 10,600,000 cu. ft. daily at 110 psi. Pipe laying will start this fall with completion due for the spring of 1959. The line will be coated with asphalt and "jute wrapped."

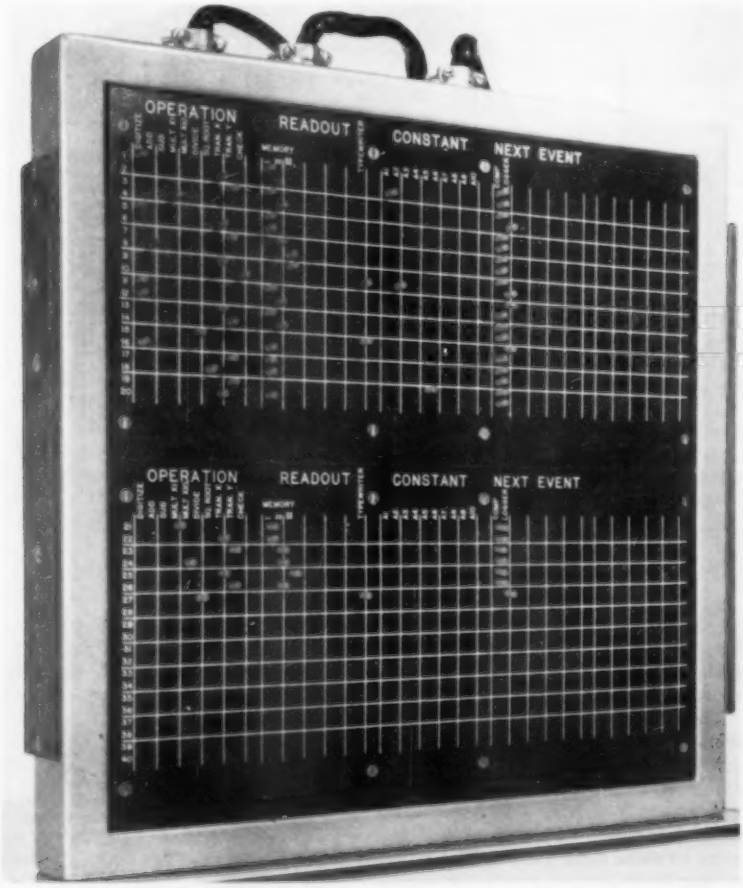
Permission to build a fourth gas conservation plant in Lake Maracaibo has been granted to Creole Petroleum Corp. by the Venezuelan Ministry of Mines. The Bachaquero 1 plant will compress 150 million cubic feet daily of gas, which will be sent to Tia Juana field for reinjection. Creole's Tia Juana plants 1 and 2 are in operation, and a third plant is under construction.

The Nigerian wildcats have been abandoned by Shell-B. P. Exploration Co. Ohuru 1, 27 miles northwest of Port Harcourt, was bottomed at 10,000 ft. after finding traces only. Aiddo 1, the northernmost well so far, was a dry hole. It was taken to 10,544 ft.

Pakistan's new 334-mile, 16-in. natural-gas pipeline from Sui field north to the Multan industrial area has gone into operation. Completed in 500 days, the gas line crosses two major rivers. It can move 75,000,000 cu. ft. of gas daily to industrial customers in Multan without any compressing facilities.

THE OIL AND GAS JOURNAL PRESENTS A

SPECIAL SECTION ON Automatic Data Handling



A COMPUTING-FUNCTION PINBOARD like this may be used in operating guide computation.

Pinboard technique gives flexibility to data-handling systems

BY JACK T. TEED
Minneapolis-Honeywell Regulator Co.

AN AUTOMATIC logging system is amenable to a wide range of uses in the petroleum and chemical process industries.

● **Maximum logger flexibility,** required by such a wide range of uses, is measured by the ease with which certain functions can be performed:

1. Substitute one type of input for another.
2. Rearrange the sequence in which inputs are read out.
3. Change the range for input variables.
4. Set span, zero suppression, and alarm limits.

● **To provide such flexibility,** major manufacturers have adopted the pinboard-program technique. It is actually a relatively simple mathematical concept. However, for practical use, this mathematical approach must be correlated with instrument terminology. Therefore, with due apologies to mathematical sophisticated readers, we will begin with the most basic geometry of a straight line. From this we will go to a more detailed analysis of the pinboards used with the digital potentiometer system.

1. DEVELOPMENT OF PINBOARDS

The equation for a straight line, plotted on the rectangular X and Y coordinates, as in Fig. 1, is $Y = MX + B$. When $X = 0$, the equation reduces to $Y = B$, thus locating one point on the straight line. B, the point at which the line crosses the Y axis, is the zero intercept. M is the slope of the line. It is determined by constructing a small right triangle (Fig. 2) and taking the ratio of Y (ordinate) to X (abscissa). It does not matter what size the triangle we construct; the slope of the line is the same over its entire length.

Mathematically, we can specify a given straight line by listing the three values—B, Y, and X—provided that X and Y apply to the same right triangle.

Instead of X and Y coordinates, we

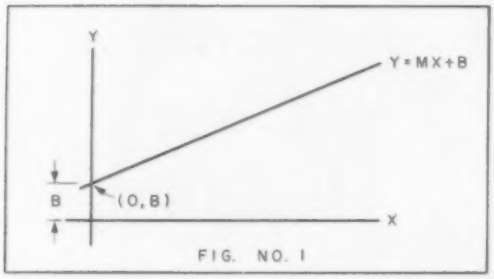


FIG. NO. 1

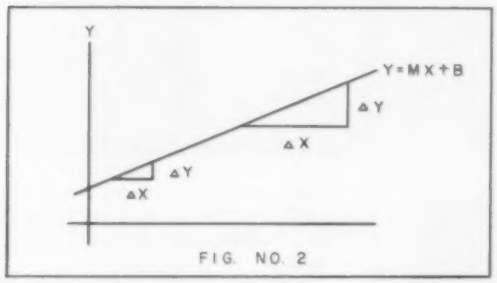


FIG. NO. 2

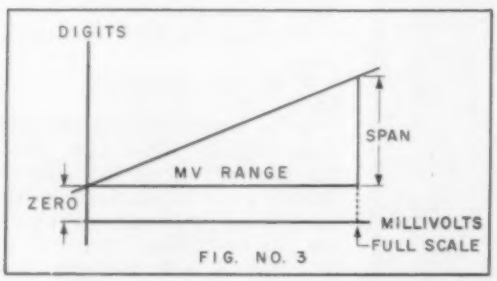


FIG. NO. 3

TABLE NO. 1

POINT NO.	MILLIVOLT RANGE	SPAN	ZERO
1	100	8524	0000
2	20	1750	1000
3	50	3870	0000
4	100	2000	1325
5	50	1000	2500
6	100	7622	0000
↓	↓	↓	↓
100	ETC.	ETC.	ETC

TABLE NO. 2

POINT NO.	MILLIVOLT RANGE A	B	C	D	E	F	G	H	I	J	SPAN	ZERO
1				X							8524	0000
2		X									1750	1000
3			X								3870	0000
4				X							2000	1325
5			X								1000	2500
6				X							7622	0000
↓											↓	↓
100												

POINT NO.	MILLIVOLT RANGE A	B	C	D	E	F	G	H	I	J
1	○	○	○	●	○	○	○	○	○	○
2	○	●	○	○	○	○	○	○	○	○
3	○	○	●	○	○	○	○	○	○	○
4	○	○	○	●	○	○	○	○	○	○
5	○	○	●	○	○	○	○	○	○	○
6	○	○	○	●	○	○	○	○	○	○
↓										
ETC.										

MILLIVOLT RANGE pinboard. Fig. 4.

use **millivolts** and **digits.** In the mathematical example, any value of X has a corresponding value of Y. In the instrumentation application, each millivoltage from the transducer has a corresponding digital value. Take a transducer with a 0 to 50 mv. range. Say the 50 mv. represents 2,400 psi., then 25 mv. would correspond to 1,200 psi. This relationship of digits (in this case, psi.) to millivolts is then the exact analogy of the equation $Y = MX + B$ as long as we think of Y as **"digits"** and X as **"millivolts."**

Let us again draw the same straight line, only this time using millivolts and digits as our coordinates (Fig. 3).

In mathematical terms, the value of Y when $X = 0$ was called B, or zero intercept. In the instrumentation terms, the digital output corresponding to zero millivolts is called **digital zero suppression,** or in our abbreviated pinboard terminology, ZERO.

To determine the slope, we again construct a right triangle. This time we use the total millivolt range of the transducer as the horizontal leg. We call the vertical leg **of this particular triangle,** SPAN, expressed in terms of digits.

There is then an exact mathematical analogy between the instrumentation terms SPAN, ZERO, and MILLIVOLT RANGE and the mathematical equation $Y = MX + B$. Any transducer calibration can be specified in terms of these three factors. The **ratio** of span to millivolt range is the slope of the curve and zero is the 0 intercept.

Range, span and zero charts . . . In a data-handling system, with inputs from 100 different transducers, we would specify all inputs on a chart, such as Table 1. As will be shown later, the pinboards are simply the mechanical equivalent of such a chart. Setting up the chart requires a few simple rules.

Since millivolt range is what determines the amplification in the measuring system, we could supply 10 fixed millivolt ranges labeled "A to J." For instance, "A" could equal 10 mv., "B" = 20 mv., "C" = 50 mv., "D" = 100 mv., etc. Our table actually looks like Table 2 with 10 preselected millivolt ranges (A to J).

The Author

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In a practical situation, there must be some restraint on the size of the number that is placed in the span and zero columns. We always try to have as much resolution as possible in the span and zero columns. The equipment is basically accurate to 1 part in 1,000, making 2,000 accurate to ±2 digits, the number 4,000 to ±4 digits and 8,000 accurate to ±8 digits.

Best Utilization of Span

The largest number we employ is 10,000, a number with a resolution 10 times as great as the accuracy.

How to utilize this span from 0 to 10,000 will next be explained.

Suppose we want to use the digital potentiometer to record the output of a transducer with a span of 26 psi. The first choice that comes to mind is a span of 26. The number 26 has a resolution 1 part in 26 (approximately 4 parts in 100) or 4%. This resolution by no means makes best use of the 0.1% accuracy of the digital potentiometer system. Now if we choose a span of 260 and remember to divide the answer by 10, we have a resolution of 1 part in 260 or approximately 0.4%. If we go still further, and call the number 2,600, (keeping in mind that we must divide the answer by 100), we express the number with a resolution of 0.04% which **does** utilize the full 0.1% accuracy of the digital potentiometer.

In sum, using nontechnical terms, employ the largest **number** you can, (up to a maximum of 10,000) for span, multiplying or dividing by whatever power of 10 is necessary. So, a span of 26 is inserted as 2,600 and a span of 2,600,000 is also inserted as 2,600. A span of 120 is inserted as 1,200 and so on. We must remember, of course, always to use the **same** power of 10 for **both** span and zero.

POINT NO.	HIGH ALARM			
	THOUSANDS	HUNDREDS	TENS	UNITS
	0123456789	0123456789	0123456789	0123456789
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
	LO ALARM			

HIGH AND LOW ALARM pinboard. Fig. 7.

Millivolt Range

Let's take another look at Table 2. It shows 10 available millivolt ranges (labeled A to J). For each of the inputs, you put an X in the proper column. A pinboard for millivolt range is a bakelite chart with a horizontal row for each input, numbered down the left-hand margin, and 10 vertical columns of sockets. Instead of putting an X in each horizontal row in the proper vertical column, as you do in the chart, you simply insert a pin in the proper socket. Fig. 4 shows a millivolt range pinboard.

Span

Again referring to Table 2, you see four figures in the span section, one for thousands, one for hundreds, one for tens, and one for units. The number 8,524 is written with an **8** in the **thousands column, 5** in the **hundreds column, 2** in the **tens column,** and **4** in the **units column.** On a span pinboard, the **units column** is very similar to the millivolt range pinboard. Each horizontal row has 10 sockets numbered 0 to 9. To choose a 6 in the units column, you insert a pin in socket number 6 of the pinboard, where you would write the number 6 on the chart. There are similar pinboard sections for tens, hundreds, and thousands. The units, tens, hundreds, and thousands section each have 10 columns numbered 0 to 9, allowing us to pin any number from 0,000 to 9,999. This is shown in Fig. 5.

POINT NO.	SPAN			
	THOUSANDS	HUNDREDS	TENS	UNITS
	0123456789	0123456789	0123456789	0123456789
1				
2				
3				
4				
↓	↓	↓	↓	↓
20				

SPAN pinboard. Fig. 5.

POINT NO.	MILLIVOLT RANGE	SPAN			
	ABCDEFGHIJ	THOUSANDS	HUNDREDS	TENS	UNITS
		0123456789	0123456789	0123456789	0123456789
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
		ZERO			

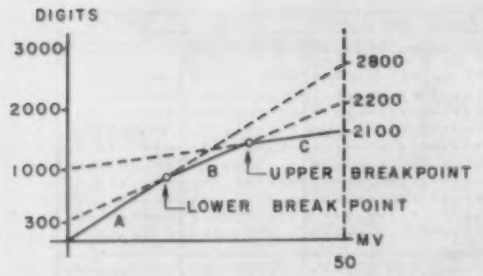
RANGE, SPAN, AND ZERO suppression pinboard for 10 inputs. Fig. 6.

Combined Range-Span

For compactness, we combine the millivolt range and span sections on a single pinboard. Such a pinboard, with 20 horizontal rows, is the mechanical equivalent of a 20-line chart with millivolt range and span columns.

Zero Suppression

A zero pinboard is identical to a span pinboard and numbers are set



DIGITS-TO-MILLIVOLT relationship for hypothetical transducer. Fig. 8.

TABLE NO. 3

SEGMENT	MILLIVOLT RANGE A	B	C	D	E	F	G	H	I	J	SPAN	ZERO
A					X						2800	0000
B					X						1900	0300
C					X						1100	1000
MV RANGE "e" = 50 MV.												

up in the same manner. Fig. 6 shows a board combining millivolt range, span, and zero for 10 inputs.

2. PINBOARD FUNCTIONS

Now, let's look at the specific pinboard functions in more detail.

Span Pinboards

For each input variable connected to the span pinboards (except thermocouples) two basic functions are established. One of the available measuring circuits (up to 10 can be provided) is selected merely by placing one pin in the measuring circuit section of the board. Placing a pin in each of the thousands, hundreds, tens, and units sections of the board establishes the span in actual digits of measurement. No calculations are required.

Scale factoring . . . When setting span, we are "scale factoring" or establishing the digital readout range in psi., g.p.h., etc., for the range of the electrical input signal. This signal may be a transduced air pressure or direct intelligence from an electrical transmission device.

Assume, for example, a transduced 0-100-mv. signal from a linear flow transmitter with a range of 0-4,350 bbl. per day.

An obvious approach is to reduce the input signal across a voltage dividing circuit to 43.5 mv. This scale-factored signal is balanced by a comparison voltage, which is digitized and read out as 4,350.

The voltage dividing circuit in the digital potentiometer consists of 16 pairs of precision fixed resistors. To adjust the voltage divider to its proper value, it is only necessary to combine the proper resistors, which are switched into the circuit by mercury-wetted contact span relays. Placing pins in the span pinboard, for a particular input variable, establishes the required closure pattern for these relays so that the necessary resistors are automatically switched into the divider circuit for scale factoring that input when it is selected for measurement.

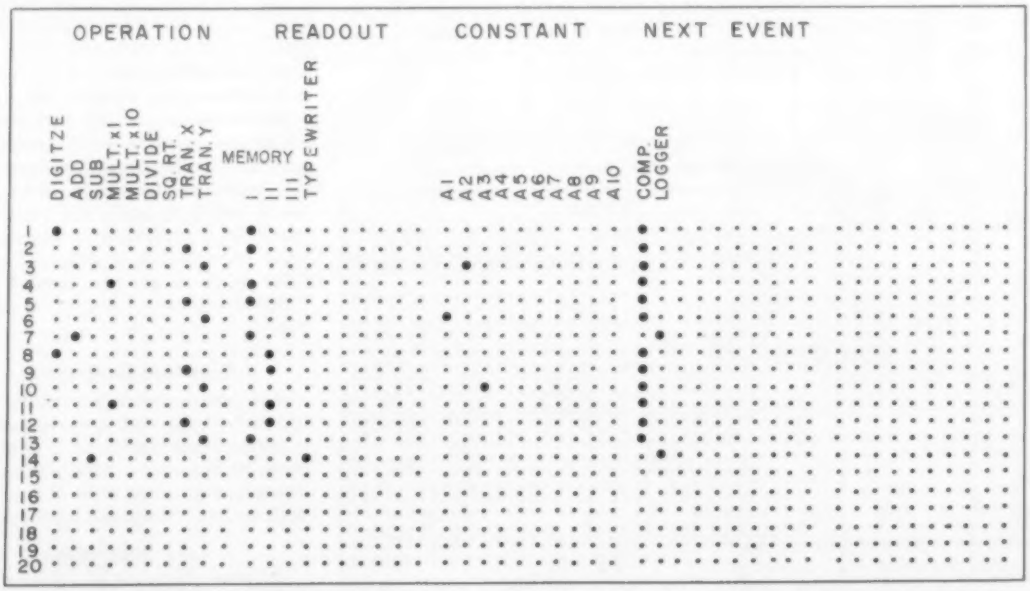
Programing pulse . . . It is important to note that the analog input signal does not go through the pinboards. An electrical programing pulse, selected simultaneously with the input signal, is connected to the pinboards. Pin locations establish the path for the programing pulse to follow so that the proper relay pattern is energized for scale factoring.

Span pinboards are supplied in increments of 20 adjustment lines. In systems where each input variable requires individual span setting, the capacity per pinboard is 20 points. In cases where certain inputs will always require the same span setting, these variables can share the same line resulting in increased capacity per board.

Zero Pinboards

Zero suppression (or "zero offset") of input variables is accomplished by adding a suppression voltage to the input signal.

Add suppression voltage . . . Assume we want to read out a 0-100-mv. sig-



COMPUTING FUNCTION PINBOARD shows typical sequence layout for determining enthalpy of steam. Fig. 9.

nal (converted from milliamps) from an electric pressure transmitter having a suppressed range of 400-1,000 psi. Span adjustment could reduce the input signal to 60 mv., which would be read out as 0-600 psi. This gives the proper span. By adding a 40-mv. zero suppression signal, the 60-mv. measured variable signal becomes 40-100 mv. and would read out in a range of 400-1,000 psi.

The supply for the suppression voltage is connected across a voltage divider circuit made up of high-precision fixed resistors. The method of selecting the proper resistors for a desired zero suppression is the same as that used for span or scale-factor adjustments.

One line on the zero suppression pinboard (or on the zero suppression **section** of the pinboard, if the one pinboard is divided into both span and zero settings) is reserved for each suppression circuit. Inputs always having the same suppression can share the same line.

Pinning the digital value of the desired suppression for an input variable will cause relays to select the proper resistors, and thus obtain the proper suppression voltage, at the same time the input is selected.

Zero suppression may be either plus or minus, as selected on the pinboard, and can have any value of 0-9,999 digits.

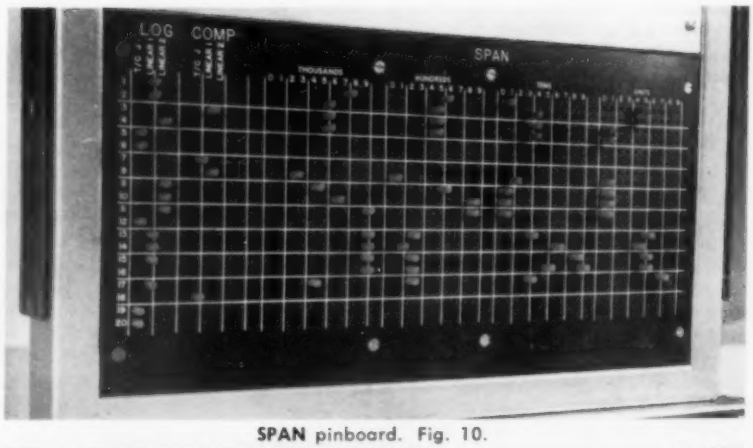
Alarm (Hi and Lo) Pinboards

In systems which include comparison of some or all of the input variables with preset alarm values, these high and/or low setpoints are pinned on an alarm pinboard in the same way as span and zero suppression values are pinned.

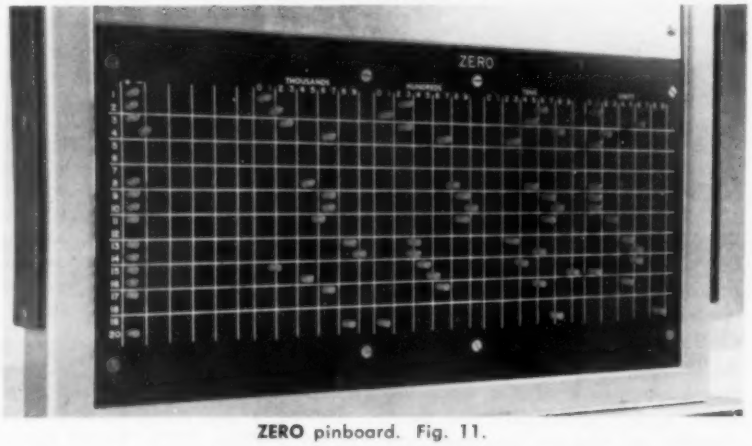
Same layout . . . The alarm setpoints pinboard has the same general layout as the span and zero boards (see Fig. 7). There are four groups of digital jacks for setting thousands, hundreds, tens, and units. Each group is numbered 0-9 which permits setting the alarm setpoints to any value between 0-9,999 digits.

Each variable to be compared against an alarm setpoint has it own horizontal line, except that inputs having the same setpoint can share a line.

High and/or low . . . Pinboards can be provided for setting individual high **and** low alarms values; or a high **or** low arrangement can be supplied in which the operator can select whether the value being pinned is high **or** low, but not both.



SPAN pinboard. Fig. 10.



ZERO pinboard. Fig. 11.

Input variables can be divided into any ratio of high alarm points only and low alarm points only. For example, a 20-input board might have 16 high alarm only points and 4 low. The process requirements will determine the distribution of desired high and low alarm setpoints.

Pinboards and Thermocouples

Thermocouple measurements represent the most common input to an automatic data-handling system. It is therefore important that these measurements be handled in the simplest and most flexible manner. The pinboard concept as used in the digital potentiometer system provides this.

Type of T.C. measuring circuit . . . In systems offering maximum flexibility, where there is a span and zero adjustment position plus a variety of measuring circuits available for each input, only **one** function need be selected on the pinboards, for each input signal from a thermocouple. It is only necessary to pin in, or select, the type of thermocouple measuring circuit required for each particular input.

No settings for span or zero are necessary because the digital potentiometer system automatically linearizes over the entire usable range of each type of thermocouple, to an accuracy of 1°. For example, Iron Constantan measuring circuits are factory calibrated for a range of —100° to 1,600° F.

Settings and Changes—System in Operation

Span, zero suppression, and alarm setpoint values may be set or changed while the system is in operation. No indication of the input variable is required nor any auxiliary voltage source. Revised settings can be made to meet the new conditions, merely by relocating the pins to their new positions.

Pinboards for Calibrating Nonlinear Transducers

Many users of data-handling equipment are sometimes able to determine the exact calibration of their transducers so precisely that they can plot nonlinearities of 0.1 to 0.5% magnitude. Fig. 8 shows the digits-to-milli-

volts relationship for a hypothetical transducer. (The nonlinearity is exaggerated since a reasonable nonlinearity plotted on a graph of this scale could not be distinguished from a straight line.) We draw the best approximation of that curve with three straight-line segments, labeled A, B, and C. Each of these segments is specified exactly by its millivolt range, span, and zero.

For simplicity, the full millivolt range (50 mv.) is pinned for all three segments. Span is determined for each segment as if it **extended** from 0 to 50 mv. And zero is the value the extended segment would have at 0 mv.

Table 3 showing Span, zero, and millivolt range for the transducer of Fig. 8, will illustrate the procedure.

Span, zero, and millivolt range, as shown on the chart, are set up on a calibrated pinboard. We also set the "breakpoints" on a pinboard (identical in function to a HI and LO alarm pinboard), in the same units used on span and zero. The lower breakpoint is 933 and the upper 1,777.

Breakpoint comparison . . . Note that the lower breakpoint is the intersection of segment A and segment B; the upper breakpoint of segments B and C. Both breakpoints are on segment B. The digital potentiometer system determines which of the three segments applies to the particular measurement by making an upper and lower breakpoint comparison (identical to high and low comparison), with the span and zero for segment B.

As in HI and LO alarm, the system automatically determines whether the input from the transducer is above the upper breakpoint, below the lower breakpoint, or between the values of the upper and lower breakpoint. If the input is above the upper breakpoint, the system automatically switches to the span and zero for segment C. Likewise, if the input turns out to be below the lower breakpoint, the unit automatically chooses the span and zero for segment A; and if the value is between the upper and lower breakpoints, the measurement is made on segment B.

Calibration pinboards provide the means of very accurately measuring the output of transducers with known nonlinear characteristics.

Pinboards for Computing Functions

For automatic data-handling systems requiring the computation of operating guides a unit having a computing function pinboard may be supplied. (Fig. 9 shows a typical sequence layout for determining the enthalpy of steam.)

Board sections . . . The board may consist of four sections. The first may provide nine different functions: digitize, add, subtract, multiply XI, multiply X10, divide, square root, transfer X, and transfer Y. The second section is for selecting the memory storage units or typewriter readout. The next is for selecting constants for arithmetic manipulation. The last section transfers control back to the data logger itself after a computation has been completed. A control section in the logger will transfer this function back to the unit when required.

3. PINBOARD CONSTRUCTION AND WIRING

Honeywell pinboards, supplied for selecting span and zero, for setting alarm points, and for computing functions all have the same physical dimensions and basic construction. They are 15 in. long and 7½ in. high, and each board provides 20 horizontal positions. These pinboards are constructed of a high-grade insulating material, with beryllium copper inserts used as the jacks for pin connections.

Jacks . . . The standard pinboards have 4 groups of 10 jacks, for the thousands, hundreds, tens, and units; allowing a pin setup of any value from 0,000 to 9,999. To the left of these vertical columns there is another group of vertical columns representing the ranges of the various transducer outputs. A standard pinboard is supplied with a maximum of 10 of these range-selection columns.

The various digital ranges involved in a system are set up on the pinboard by inserting pins in the jacks corresponding to the ranges of the various inputs, as shown in the previous illustrations.

Wiring . . . The jacks of these 10 vertical range selection columns are wired internally to the digital potentiometer. The other 40 vertical rows of jacks (representing the thousands, hundreds, tens and digits) are wired to code matrices for conversion from a 10-position (0-9) decimal code to a 4-position binary decimal code. This code conversion permits a group of 4 relays to represent a single digit from 0 to 9, rather than using 10 relays for the same purpose. Each digit group has its own separate code-conversion matrix.

Front and rear components . . . Each insert jack in the pinboard has two parts to its circuit, a front component and a rear component, the two insulated from each other. The digital banks of the pinboards are so wired that all the jacks of each vertical column are tied together through one jack component, and all the jacks of each horizontal row are tied together through the other component of each jack.

The front components of each digit column are wired together, and the rear components of all jacks in each horizontal row, so that 0 through 9 jacks are wired together, and all the 9's are wired together, and this latter wire is one of those leading to the 10-to-4-position code matrix of the tens group of digits. The same wiring procedure is followed for the entire bank of jacks on the pinboard.

Pulse travel . . . During system operation, as the input selector switch steps to a given point, a pulse travels (from the programing level of that point) to the proper input position on the pinboard, to the four groups of jacks representing the thousands, hundreds, tens, and units, and the range-selection column.

Since the jacks in each horizontal line are all wired together through one jack component, the pulse will feed all four digit jacks simultaneously. The pulses will pass through the circuits containing pins, and will set up the conversion matrices through the vertical jack components.

Relays . . . The output of the code-conversion matrices is fed to a group of 16 relays. These span relays are divided into four groups of four each. This arrangement of relays provides the 5-2-1-1 code used in the digital potentiometer. The contacts of these span relays are used to control the voltage dividing networks at the output of the preamplifier used in the digital potentiometer.

Relay pattern . . . The placement of the pins in the pinboard controls the relay pattern for the particular point being measured. This type of scale factoring provides a digital division of the voltage being measured, thereby (as has been pointed out) securing greater accuracy and resolution than can be obtained by the use of manually set potentiometers.

In sum . . . The pinboard approach provides simplicity of operation plus inherent flexibility. Thus application of this technique is wide in scope for the continuous process industries both in pilot plant and full-scale process-unit operation.

THIS 400-CHANNEL LOGGER INSTALLATION covers various sections of a critical petrochemical-manufacturing facility.

Phillips' Sweeny Logger

. . . It helps ethylene unit operators

This high-reliability logger does not come cheap. But it could be well justified by a relatively small improvement in the pyrolysis product yield. Future step-by-step application calls for tie-in with: (1) ethylene-plant accounting procedures, (2) out-of-plant digital computations aimed toward optimum olefin yield, (3) inplant computers for automatic calculation of operating guides, and (4) ultimate closed-loop optimization.

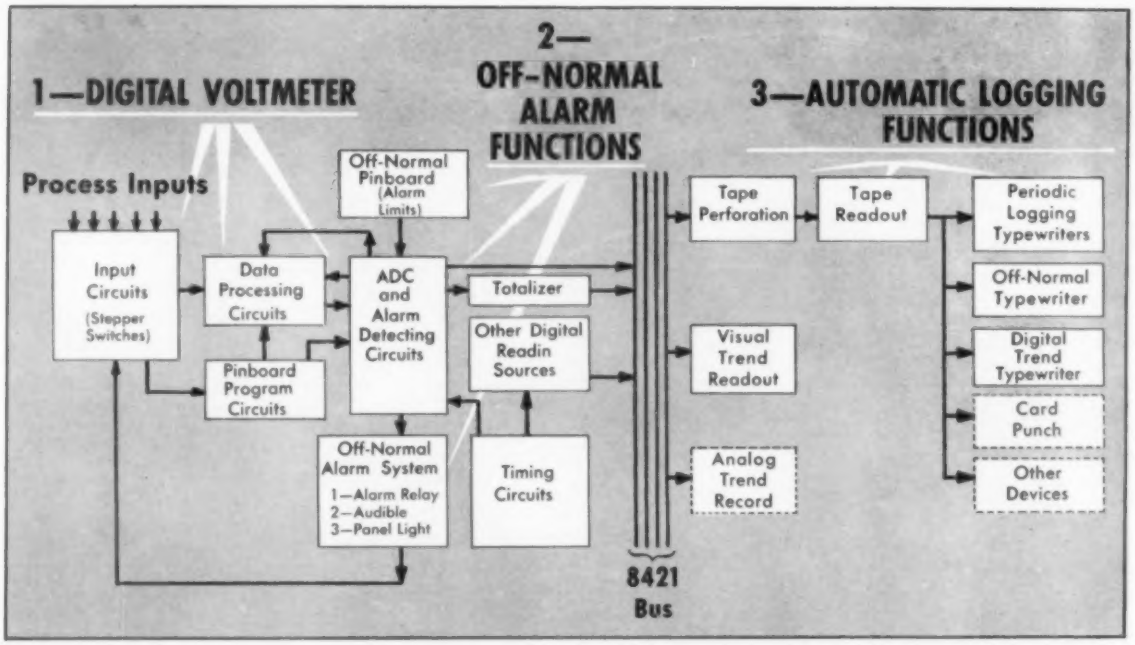
BY J. G. ALLEN AND G. L. SMITH
Phillips Petroleum Co.
Bartlesville, Okla.

THE PHILLIPS ethylene-plant data logger was recently proved out on reliability, an item of prime concern in continuously operating logger systems. The Swenny logger passed its 30-day acceptance test with very minor down time. This particular logger, a Beckman model 112 system, is a 400-channel installation which covers the pyrolysis section, compressor system, and fractionation section of the 180,000,000-lb. per year ethylene plant located at the Sweeny, Tex., refinery. The ethylene plant is owned by Phillips Chemical Co. and operated by the Phillips Petroleum Co. refining department.

● **Like most other** loggers today, this is an exploratory installation operated in parallel with a conventional plan instrumentation system. But operators have found it almost immediately useful. Ethylene-plant operation is not particularly easy; by removing the manual logging chore, the operator has been freed for other important duties.

● **Beyond that** Sweeny operators have latched on quickly to the digital trend feature by which any desired 30 points can be selected and programed for separate printout. This has been especially useful in startup and shutdown of cracking heaters. The off-normal alarm and readout feature has been another distinct aid to operators.

● **The 30-point** digital trend is programed on a separate pinboard by the operator himself. There are three other program pinboards, including the off-normal (high-and-low limits) pinboard. A visual (digital voltmeter) readout is also provided. The operator can select any one channel for visual readout.



MAJOR SYSTEM functions are indicated. Inputs are selected through the stepper switches and processed by the data-processing circuits as determined by pinboard programing. Next the ADC (analog-to-digital converter) digitizes and measures the analog information. It is then deposited on the four-channel trunk. Fig. 1.

1. LOGGING AND PROGRAMING

The Beckman 112 system design is based on use of magnetic core circuitry, transistors, and crystal diodes with the aim of obtaining high reliability. Basic system building block is a 50-channel scanning module. This is an input switching module with its own preamplifier and program pinboard. Ample computation capacity is provided for such operations as temperature-and-pressure compensation of gas flows, integration of flows, and linearization of thermocouple characteristics. Certain of these functions can be left out initially, and added later as desired, by virtue of the modular design.

The combined functions are indicated in the much-simplified block diagram, Fig. 1. Major system functions are: (1) digital voltmeter, (2) automatic logging, and (3) off-normal alarm.

Digital voltmeter functions . . . This includes the input circuits, data-processing circuits, and ADC (analog-to-digital converter). Input analog signals first are scanned by the input circuits, and then are processed by the data-processing circuits as determined by pinboard programing. The data-processing section takes an input voltage (corresponding to a process variable value) and converts this voltage to a current analogous to the number of digits representing the process variable.

Next the ADC (in essence a transistorized high-speed switching network) digitizes and measures the processed analog information. It is then deposited (fed in parallel) in binary code, on the four-channel trunk (8,421 bus). From this it can be extracted for regular logging or computation storage.

The digital functions can be expanded. Additional digital sources can be fed to the 8,421 bus: (1) real time for log cycle identification, (2) channel number for process identification, (3) code groups generated internally and externally, for checking and other purposes, and (4) totalizer, which yields totalized successive readings from a given channel for periodic printing of totals and averages.

Logging functions . . . The logging-section equipment includes tape perforator, tape reader, and logging typewriters. The digitized data are recorded on perforated tape, read (decoded) by the tape readout, and relayed to the logging typewriters.

Off-normal alarm functions . . . This detects and announces off-normal measurements. The alarm functions are controlled high-and-low limits pinned into the off-normal pinboard. In Fig. 1 the off-normal detection circuits are included in the ADC section. The alarm detector, in connection with the ADC system, recognizes off-limit conditions and forwards the information to perform the following:

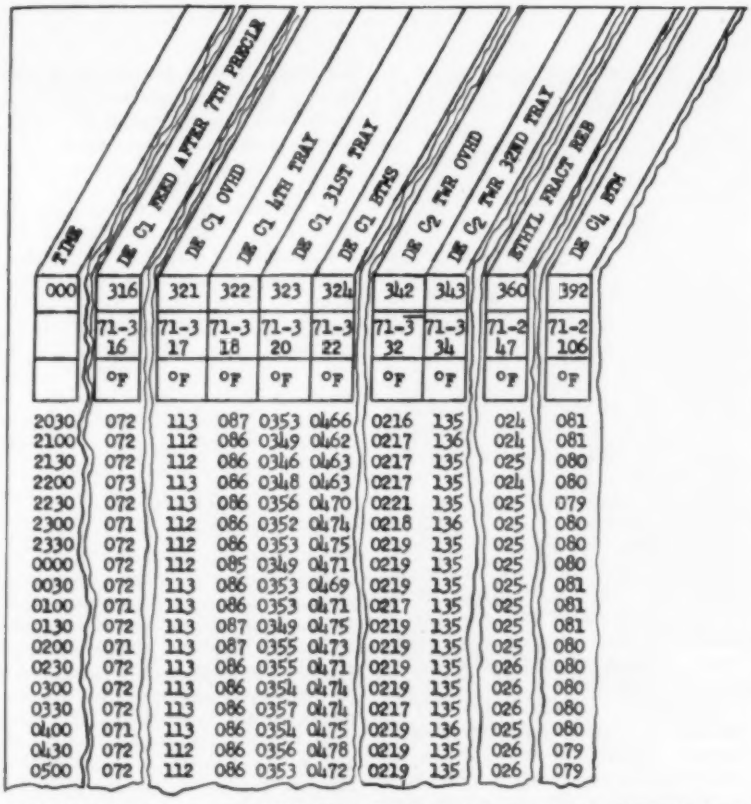
The Author

G. L. SMITH

J. G. ALLEN

J. G. Allen has been chief process engineer of the refining department of Phillips Petroleum Co. since 1947. He was born and educated in Tulsa, graduating from University of Tulsa with a B.S. degree in chemistry in 1933. Since March 1933 he has worked for Phillips; 2 years at the Borger, Tex. refinery, 7 years at the Kansas City, Kans., refinery, and the remainder of the time in the home office. In the refineries he participated in pilot-plant development of liquid copper chloride treating and plant development of thermal polymerization of propane and butane.

George L. Smith is senior design engineer in the instrument section of the Phillips Petroleum Co.'s refining department, engineering division. He has been active in the Sweeny data-logger installation—in the factory checkout, plant installation, initial operation and acceptance testing phases of this project. Smith received the B.S. degree in electrical engineering in 1952 from Utah State University. He joined the Phillips Atomic Energy Division at Idaho Falls, Idaho, in June 1952 and spent 5 years in the electronic-instrument development section at the materials-testing reactor facility. In June 1957 he transferred to the Phillips refining department at the Woods Cross, Utah, refinery. In December 1957 he transferred to Bartlesville in his present capacity.



TIME	DE C1 FEED AFTER 7TH PENCIL	DE C1 OVHD	DE C1 4TH TRAY	DE C1 31ST TRAY	DE C1 BTMS	DE C2 TWR OVHD	DE C2 TWR 32ND TRAY	ETHYL FRACT FEED	DE C4 BTM
000	316	321	322	323	324	342	343	360	392
	71-3 16	71-3 17	71-3 18	71-3 20	71-3 22	71-3 32	71-3 34	71-2 47	71-2 106
	°F	°F	°F	°F	°F	°F	°F	°F	°F
2030	072	113	087	0353	0466	0216	135	024	081
2100	072	112	086	0349	0462	0217	136	024	081
2130	072	112	086	0346	0463	0217	135	025	080
2200	073	113	086	0348	0463	0217	135	024	080
2230	072	113	086	0356	0470	0221	135	025	079
2300	071	112	086	0352	0474	0218	136	025	080
2330	072	112	086	0353	0475	0219	135	025	080
0000	072	112	085	0349	0471	0219	135	025	080
0030	072	113	086	0353	0469	0219	135	025	081
0100	071	113	086	0353	0471	0217	135	025	081
0130	072	113	087	0349	0475	0219	135	025	081
0200	071	113	087	0355	0473	0219	135	025	080
0230	072	113	086	0355	0471	0219	135	026	080
0300	072	113	086	0354	0474	0219	135	026	080
0330	072	113	086	0357	0474	0217	135	026	080
0400	071	113	086	0354	0475	0219	136	025	080
0430	072	112	086	0356	0478	0219	135	026	079
0500	072	112	086	0353	0472	0219	135	026	079

PERIODIC LOG above, and **DIGITAL TREND LOG** below. Certain channels from regular periodic logs are shown corresponding to same channels on digital-trend sheet for given time period. Figs. 2 and 3.

Automatic Data Handling

1. Print out data on off-normal typewriter. As soon as process variable is off normal, values print out in red. When measurement returns to normal, data print is in black.

2. Audible (chime) and visual (flashing light) alarms warn the operator.

3. An individual light is also provided for each channel. When a variable goes off limits this light illuminates to identify the particular variable.

The repeating chime and flashing master lamp go off when the off-normal recognition button is pushed in. But the individual channel light remains lit as long as the channel is in alarm condition.

Programing

Pinboards are used to control most of the automatic "reasoning" functions of the 112 system and also can serve as "memory" devices. (See Teed on Pinboard Technique.) Three pinboards are located on the input cabinet:

1. Channel program.
2. Group program (full scale, range, zero offset, etc.)
3. Off normal.

DIGITAL TREND 9-17-58

2030	316 070	321 107	322 083	323 0352	324 0466	342 0227	343 137	360 028	392 080
2045	316 069	321 105	322 079	323 0334	324 0468	342 0219	343 138	360 028	392 080
2100	316 069	321 105	322 079	323 0348	324 0458	342 0225	343 137	360 027	392 080
2115	316 069	321 104	322 079	323 0349	324 0462	342 0225	343 138	360 029	392 080
2130	316 070	321 104	322 081	323 0349	324 0462	342 0225	343 137	360 028	392 080
2145	316 069	321 104	322 081	323 0344	324 0459	342 0223	343 138	360 028	392 080
2200	316 069	321 104	322 082	323 0348	324 0454	342 0230	343 137	360 028	392 080
2215	316 069	321 106	322 082	323 0348	324 0455	342 0230	343 137	360 028	392 080
2230	316 070	321 107	322 083	323 0349	324 0454	342 0230	343 138	360 028	392 080
2245	316 070	321 108	322 083	323 0345	324 0457	342 0226	343 137	360 027	392 080
2300	316 069	321 109	322 083	323 0348	324 0458	342 0224	343 138	360 028	392 079
2315	316 069	321 109	322 082	323 0348	324 0459	342 0224	343 137	360 027	392 079
2330	316 069	321 109	322 083	323 0349	324 0462	342 0226	343 137	360 028	392 079
2345	316 069	321 109	322 083	323 0352	324 0462	342 0228	343 137	360 028	392 079
0000	316 069	321 110	322 084	323 0355	324 0462	342 0230	343 137	360 028	392 079
0015	316 070	321 111	322 085	323 0352	324 0461	342 0232	343 138	360 027	392 079
0030	316 069	321 112	322 086	323 0354	324 0463	342 0235	343 137	360 028	392 079
0045	316 069	321 113	322 087	323 0353	324 0465	342 0230	343 137	360 028	392 079
0100	316 069	321 113	322 087	323 0356	324 0465	342 0227	343 138	360 027	392 078
0115	316 069	321 113	322 087	323 0357	324 0467	342 0225	343 138	360 027	392 078
0130	316 068	321 113	322 087	323 0356	324 0466	342 0224	343 138	360 028	392 078
0145	316 069	321 113	322 087	323 0353	324 0468	342 0224	343 138	360 027	392 078
0200	316 069	321 114	322 087	323 0354	324 0468	342 0228	343 138	360 028	392 078
0215	316 069	321 114	322 087	323 0354	324 0466	342 0226	343 138	360 028	392 078
0230	316 069	321 114	322 087	323 0357	324 0470	342 0227	343 138	360 027	392 078
0245	316 069	321 114	322 087	323 0357	324 0469	342 0226	343 138	360 027	392 079
0300	316 069	321 114	322 087	323 0357	324 0470	342 0226	343 138	360 027	392 078
0315	316 069	321 114	322 087	323 0357	324 0469	342 0226	343 138	360 027	392 078
0330	316 069	321 113	322 087	323 0354	324 0468	342 0227	343 138	360 027	392 078
0345	316 069	321 114	322 087	323 0355	324 0470	342 0227	343 138	360 027	392 079
0400	316 069	321 114	322 087	323 0356	324 0467	342 0227	343 138	360 027	392 079
0415	316 069	321 113	322 087	323 0354	324 0470	342 0225	343 138	360 027	392 079
0430	316 069	321 113	322 087	323 0354	324 0471	342 0226	343 138	360 027	392 079
0445	316 069	321 113	322 087	323 0354	324 0470	342 0226	343 137	360 027	392 079
0500	316 069	321 112	322 087	323 0361	324 0468	342 0228	343 137	360 027	392 078

The fourth pinboard is located, as noted, on the operator's console:

4. Digital trend.

Channel program pinboard . . . There is an individual horizontal program line for each channel. Pins are inserted along this line to establish: (1) source of information being fed to that channel—whether analog signals, time, or code groups, (2) program number for assigned scaling and zero offset group, (3) decision to store for computer, plus instructions for performing mathematical computations—i.e., add, subtract, multiply, divide, or square root, (4) assignment of a totalizing register, (5) the number of digits to be printed out, and (6) assignment of typewriters for readout.

Group program pinboard . . . Each one of these provides for 50 scaling and zero offset programs. Any number of individual inputs from the channel program pinboard can be routed through and processed by the appropriate group program. A group program may include: (1) selection of a full-scale readout range—whether 2,000, 4,000, or 10,000 digits, (2) register of programed full scale in millivolts, (3) amount of zero offset in readout units, (4) the applicable linearization function, and (5) assignment of fixed absolute values for computer storage.

Off-normal pinboard . . . This, just like the channel program pinboard, provides a horizontal line for each channel. On this line are pinned high and low alarm limits in terms of direct readout units. The alarm system becomes energized when the process variable overruns any limit.

Digital trend pinboard . . . This is the center panel of the control console. Its function is to select channels scheduled for trend recording. The operator has access to all channels with this pinboard; however, the capacity of a single typewriter is limited to 30 channels for trend logging purposes. The console is equipped with two off-normal indicating panels, located at each end of the central control section. Each of these alarm-indicating panels houses up to 200 lamps. The individual lamps are identified by channel number and station designation. A lamp will light up and remain lit when the corresponding channel is in alarm condition.

Types of Logging

Periodic logging is the basic function of the system. It consists of recording the routine measurements on periodic logging typewriters at set time intervals which constitute the logging cycle. Any off-normal points at the time of logging are printed out in red. Periodic logging is supplemented by on-demand logging of all points which may be initiated by a push button.

Off-normal logging occurs only when the data from one or more channels fall outside the limits preset into the pinboard. If an off-normal should occur outside the regular logging cycle, only the off-normal typewriter is addressed. It prints out the time, the channel number, and the off-limit value. This off-normal typewriter prints in red at the beginning of an off-normal condition, then quits printing this channel for the duration of the off-normal condition, and prints again in black when the channel returns to normal.

On-demand logging is actuated by pushing the "on demand, off normal" button. Each time this is done, all off-normal channels log in red. Such logging begins at the start of the scan cycle which follows actuation of push button, and stops at end of that scan cycle.

Digital-trend logging monitors certain channels at intervals closer than the regular logging cycle of say 30 minutes. As noted, the operator can pin as many as 30 channels, out of the nearly 400 channels, into his digital trend pinboard for monitoring via the digital trend typewriter. Also, selectors are provided for choosing the digital trend logging intervals. The operator can pick certain intervals running from 1.5 minutes into the hour range.

The digital trend logging is recorded by the typewriter as follows: time in the first column, then 30 columns of channel identification, alternately spaced with 30 columns of corresponding digitized data. (Note that the ordinary logging channels print in sequence without channel identification.)

On all typewriters, if a signal is in the off-normal state, the digitized data are in red on the first copy of the log sheet, preceded by an asterisk to indicate the off-normal channels on the duplicate log sheets (for which black carbon paper is used).

2. PHILLIPS EXPERIENCE AND FUTURE USE

The Sweeny data logger may be termed a "promising" installation on the basis of Phillips' experience with it to date in regard to: (a) reliability, and (b) its use as an operating aid. Phillips hopes to obtain additional utility from this equipment in a step-by-step program of application.

Reliability

In purchasing the logging system for Sweeny, Phillips specified a 30-day acceptance test requiring maximum accumulated down time in this period to be 8 hours. Actually, following a routine debugging period, accumulated down time during the 30-day test was only 30 minutes. This reliability does cost money, but is worth paying for in assurance of continuous operation at high accuracy. (See Stover on Reliability.)

Operator's Aid

Before installation of the automatic logger, operators were required to log manually every 2 hours, a time-consuming chore, and one which could not be done cheaply with the desired accuracy. No more "hand logs"—at present the automatic logger, based on 90-second scanning of all the points, makes printouts of the many flow, pressure and temperature points, and a few analytical points on the periodic typewriter battery (5 units) every 30 minutes. A sixth typewriter is used for digital trend, and a seventh for off-normal printout.

Digital trend and off-normal . . . These features have made the operators' work easier and have led to improvements in operation. The operators have learned to follow the effect of a process change by putting in any number of desired points up to 30 on the digital trend pinboard. This digital trend feature apparently has been useful to them almost from the day the logger was installed. It has been of particular value, for example, when shutting down one heater while another is being started up simultaneously.

Advantages claimed for the off-normal feature also have been largely fulfilled, after experience had been obtained in proper settings of alarm limits on certain variables relative to behavior of these variables during upset. (Also, speaking of upsets, the value has been confirmed of having a full history of an upset printed out automatically while the operator is of necessity busy with other matters.)

Future Use

Ethylene is manufactured from light-hydrocarbon feed stocks at Sweeny by high-temperature, short-time thermal cracking in tubular reactors. A battery of seven heaters is employed. In such processing, a defined temperature gradient through the heater coil is desired to obtain

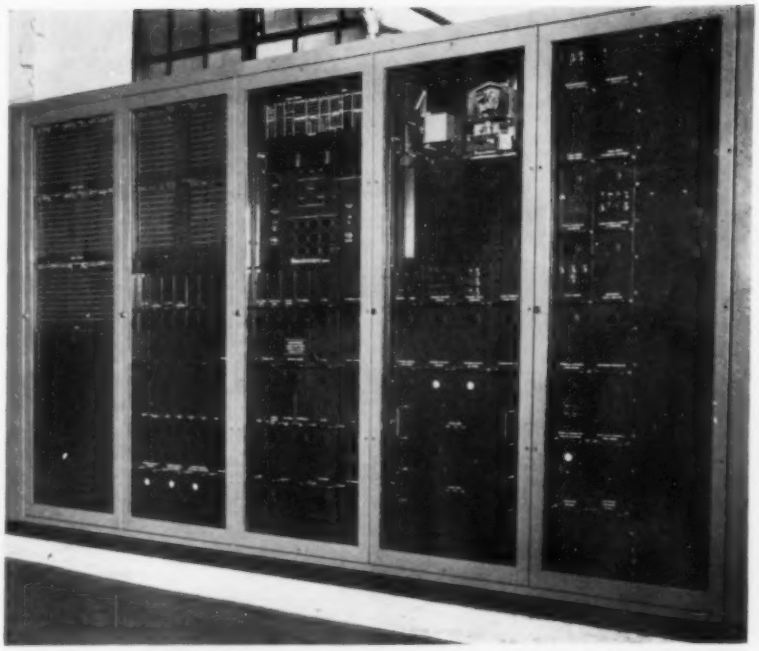
maximum ethylene yield with minimum coke formation. Temperature affects chemical reaction equilibrium and reaction rates. But there are also other limiting factors—such as excessive residence time due to heat-transfer limitations. Approach to equilibrium of the dehydrogenation reactions (hydrocarbon-ethylene-hydrogen equilibrium) has an important effect on product distribution. There is no intention to discuss these inter-relationships here; a good summation of these factors has appeared elsewhere.[3] They are mentioned merely to emphasize that there are many opportunities in ethylene processing for logger-computer applications in rapid, automatic gathering of data and calculations aimed at improving process design and operation.

Accounting use . . . Presently the logger performs such chores as converting instantaneous temperature measurements to °R and instantaneous pressure measurements to absolute pressure for compensation and averaging. Computation of averages and totalizing functions by the logger eliminates human "eyeballing" of recording charts and saves time of any engineers who may be engaged in running data at one time or another on the operating unit. To obtain data used wholly or in part for accounting purposes, some 15 laboratory analyses of various kinds are made in the ethylene plant. Also a number of infrared plant instruments analyze for per cent ethylene in various streams as, for example, monitoring ethylene losses in residual gas. These infrared monitoring data are also logged automatically.

Perhaps, in time, additional stream analyzers might be employed to replace more of the lab tests, and the resulting data logged automatically. Such possibility, plus the integrating and totalizing functions of the logger, point to a natural development: that of making an automatic material balance, say around the 5:00 a.m. logger-data line.

Out-of-plant computers . . . In design of the Phillips ethylene unit and in the analysis of unit operation, generous use has been made of the central Datatron computing facilities in Bartlesville.[4] Installation of the automatic logger has been of help in obtaining accurate data rapidly for such computations, including: (1) pyrolysis, and (2) fractionating problems.

Data taken on heaters have been employed in calculations of efficiencies, comparing one method of operation with another; and also such items as heat-transfer rates-tube limits, time-temperature effect, pressure drops, and densities through heater coil. Comparative efficiencies have been calculated mainly in connection with changes of operating variables such as hydrocarbon feed flow rate, steam flow rate, heater firing pattern, and mechanical changes in heater affecting flue-gas flow. With help from the automatic logger, data collected in the morning can be teletyped to Bartlesville and the answer received later in the same day so that adjustments can be made for another run.



LOGGER RELIABILITY is provided by use of magnetic core circuitry, transistors and crystal diodes. Fig. 4.

Gleam in the eye . . . For the future the Phillips technical staff has its eye on the tie-in of the logger with in-plant computers. Admittedly this is at present a gleam in the eye. However, Phillips feels it has the basic element in the Sweeny logging system and computation could be added as an operating aid or eventually for closed loop optimizing. The logger provides the potential for quick data gathering and the data can be put on punched tape for use by a computer.

A Step At a Time

It is our feeling that additional logger applications should be made a step at a time, and perhaps involving only a portion of the plant at any one time.

Right now the logger has undergone the first step in application: namely proving out of the system's accuracy and reliability, and giving operators, engineers, and accountants confidence in it.

For the future, we might be able to compute various operating guides that will improve efficiency of operations. For example, it might tell us in 5 minutes how to operate all our heaters exactly the same, to minimize overcracking or undercracking. We may be able to relate temperatures, as measured at various points with coke buildup and burner patterns. Right now burners are adjusted on the basis of yesterday's laboratory analysis in heater effluent, and we must wait until the next lab test results come back tomorrow to find out the effect of the adjustment.

Such an operating guide automatically calculated, is not quite feasible today. But it is something that is certainly worth striving for.

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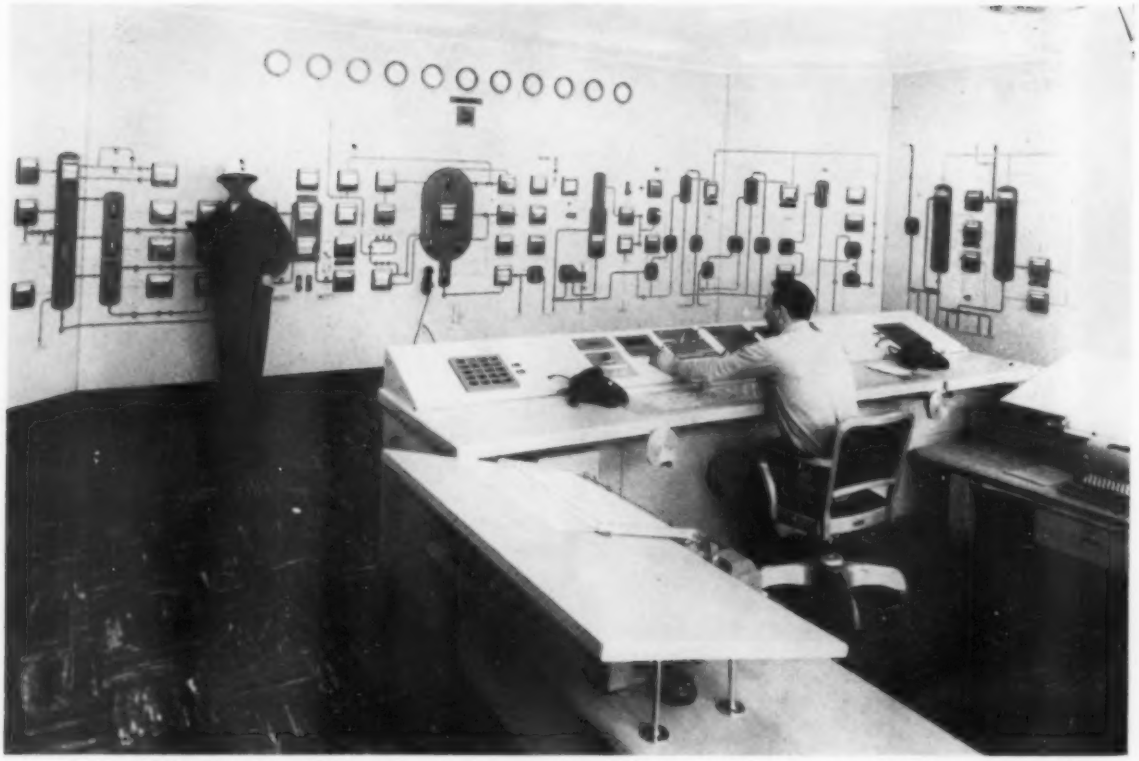

OPERATOR CAN SELECT, through a jack panel, variables for digital and analog display.

At Tidewater's Delaware refinery . . .

Scanning-logging systems operate at high efficiency

The extensive automatic information facilities at the Delaware refinery consist of 12 process scanning-logging systems and a tank-farm logger. Early problems such as operator psychology and some mechanical difficulties have been largely overcome. Now the Tidewater process scanning systems have been operating about a year.

BY W. G. DEUTSCH

IN ENGINEERING Tidewater Oil Co.'s 130,000-bbl. Delaware refinery, control systems design and process design were conducted simultaneously so that fullest advantage was taken of control techniques then available. By incorporating data logging (with trend recording and scanning), it was possible to simplify design of graphic panel boards with significant reduction in their size. Loggers employed at the plant are Panellit, Inc., 605 information systems.

The inclusion of these information systems in the Tidewater plant resulted in a reduction in the number of conventional instruments (no multipoint temperature indicators, etc.). Additional savings were realized in the length of the control panels, and therefore in reduced size of the control rooms. These savings are estimated to amount to some 20% as compared with conventional instrumentation.

• **Basic control** in the refinery depends on conventional pneumatic process controllers panel mounted in the eight central control rooms. The only recorders mounted on these control panels are those included with control instruments, i.e., as recording controllers. Refinery units can be started up and operated completely by these panel-mounted control instruments.

• **For process optimization** purposes, the operator can select, through a jack panel, any two variables for visual (digital) display and up to 16 variables for analog (strip chart) large-case trend recording. Another feature is scanning (in sequence) of all variables with printout of the off-normal points.

Utilization levels of 98% and higher have been achieved consistently over the past year; this means the systems are available for hourly logs and/or continuous scanning for 98 or

more hours out of 100. The first of the 13 data loggers was installed in December 1956, and accepted by February 1957. The remaining systems were installed and accepted by August 1957. In the early months, utilization factors were much lower. This was due to: (1) operator reluctance to accept the equipment, (2) inadequate instrument "reconciliation" (i.e., basically making all instruments on the same transmitter—indicator, recorder, and logger—read alike) and (3) component failure.

1. DELAWARE REFINERY INFORMATION SYSTEMS

The information system in use at the Tidewater Delaware refinery is essentially a logging device using a self-balancing potentiometer for measuring. A selector device (stepping switch), ahead of the self-balancing potentiometer, selects each input in turn. A print programer, which follows the self-balancing potentiometer and its digitizers, feeds the output digits to a typewriter.

Principal system features are:

1. A data console provides the operator with additional resolution and auxiliary information required to make decisions necessary for optimization. A telephone-type jack panel on the console permits the operator to select any two variables in the plant for visual digital display with a resolution of 1 part in 2,000.

2. Trend recording is made possible through the same jack panel. The operator can select certain variables for analog trend recording on full-case instruments. Up to 4 points can be selected per trend recorder, with no more than 2 such recorders provided per system. These strip-chart records are particularly valuable in determining nature and extent of process upsets. Additional console features are: (a) a lucite table top under which a detailed P. and I. diagram can be unrolled and to which the operator can refer to determine interrelationships of the various plant information points, and (b) a segregated annunciator panel through which his attention may be called to process upsets which may be critical or dangerous.

3. A scanning function is also provided. This is used to monitor, sequentially, all variables in the plant. Those which exceed preset limits are brought to the operator's attention by printing them on an electrically operated typewriter. A point is recorded the first time it goes off normal. There is no repetitive printout on succeeding scans, until the point returns to normal when it is printed again. The off-normal feature includes an alarm summary which can be obtained on demand. This printing of a summarized record of the off-normals is of particular convenience at operator shift changes.

Logging

This system is essentially a fixed-program logger. Once the inputs have been assigned a definite order, the ranges selected and the log sheets printed, no further programing operations are necessary. However, alarm limits are set manually.

Engineering department aid . . . Logging is accomplished at periodic intervals when the data logger reduces its scanning speed and sequentially prints all variables measured in the plant. Such printout is scheduled for hourly intervals, but can be produced on demand by the operator. The hourly log is of primary value to the engineering department for long-term evaluation of process performance.

Accounting purposes . . . One of the auxiliary services of the logger system is data generated for accounting purposes, such as hourly and daily flow integration. These records, made in reproducible digit form (on punched tape) are sent to the plant accounting department and entered into the daily accounting record on computer equipment.

Scanning

The scanning switches used for the periodic log are also used for off-normal scanning. During off-normal scanning, the self-balancing potentiometer measurement equipment is disconnected from the system and all inputs are measured on an analog comparison basis using separate high and low comparator channels.

Double check . . . Scanning normally proceeds at a rate of 5 points per second, except that when an off-normal is first detected the scanning cycle is interrupted for 200 milliseconds (one scanning period) while the system makes a double check on the off-normal value. If the point is still off normal on the second check, the self-balancing potentiometer is switched in, a measurement made, and an off-normal entry printed in the off-normal segment of the log chart. During scanning, when a point which has been off normal returns to normal, the same double check is made and the same printout technique used. An alarm memory is provided to suppress readout after first detection of an off-normal. Printout is suppressed until the point either returns to normal or an off-normal summary demand is required.

The system is designed so that all channels are scanned during off-normal scanning, except that any point for which there is no alarm setting (such as integrator points) are bypassed.

Setting High-Low Limits

An off-normal patchboard, built into the input selector module, provides an option of either (1) making individual settings for each channel, or (2) using a common setting for any number of channels.

Knob settings . . . Limits are set by means of dual single-turn potentiometers, one used for high and another for low for each required point or group of points. These alarm-set potentiometers permit settings to be made with a readability of 1 part in 1,000. Locking-type knobs are used so that settings will remain stable. It can be stated that the minimum difference between high and low limits may be as close as ± 1 digit. However, since it is seldom possible to hold a process on an absolutely flat course, high and low limits are generally set to discover extremes of process surges.

Limit adjustment . . . This can be made without interference with the operation of the data logger, provided that it is not necessary to read out the value of the alarm settings digitally. (During setting of limits, the system may be stopped and the high and low alarm levels read out on a visual digital indicator at the system console.) Once the operator has become used to the limit settings of his particular installation, adjustment may be made by reference to the dials of the alarm-set potentiometers.

The Author

William G. Deutsch has recently been appointed Chicago area engineering representative of Instruments Inc., Tulsa manufacturer of level and analytical instrumentation. Prior to joining Instruments Inc., Deutsch was information systems application engineer with Panellit, Inc., at Skokie, Ill., and electro-mechanical instrumentation engineer with General Electric's Aircraft Gas Turbine Division in Lynn, Mass.

He has represented many papers and lectures on digital data-handling systems, before national and local meetings of ISA, IRE, AIEE, and ASME, and at various university seminars.

Types of alarms . . . When an off-normal is first detected, a single-stroke gong mounted in the typewriter desk sounds. Provision is also made for contacts which may be wired to external annunciators. In addition, a flashing light will indicate a system fault. During a power failure, alarm and memory devices will open and will be in deenergized position immediately after the failure. At the end of the first scan cycle following a power failure, all off-normal points will have been recognized and the alarm memory condition restored.

2. TANK-FARM LOGGER

A specialized digital computer is used for processing the data from the tank storage area of the refinery. Principles employed in design of this computer are not new. But it is unique in that the design and logic have been carefully weighed to obtain an economical system for a special application—that of tank-farm data reduction.

The tank farm consists of 88 storage tanks ranging in capacity from 2,150 to 200,500 bbl. and in height from 11 to 55 ft. Object of the data-reduction system is to register automatically the volume of liquid in a given tank, corrected to 60° F. The automatic system must: (1) measure temperature and liquid height, (2) pick out volume corresponding to height from a table, (3) pick out temperature-correction factor from a second table, and (4) multiply volume by correction factor.

Measuring

Liquid height is measured remotely by Shand & Jurs level transducers. The output from these is a resistance that is proportional to height, produced on a 10-turn (foot) potentiometer and a vernier (0.01-ft.) potentiometer driven by a float mechanism. Four resistance thermometers, suspended in the liquid, measure temperature. These averaged variables are converted to digital values by a balance servo coupled to a shaft-position digital converter.

Digital printout . . . Before measurement, a series of identifying information is printed out on a servo-typer. A series of multilevel stepping switches is used to connect signal inputs from a given tank to the digital conversion mechanism. Both the typing process and data conversion are controlled by a Panellit relay and stepping switch system. Height and temperature are converted to digital form and printed.

Storage-tank material identification . . . This is set manually by operator in accordance with the refinery's code. Operator also selects one of the 13 API-classification temperature-vs.-correction factor curves, which closely approximate correction factor curves of liquids handled in the refinery. This is also set manually.

The temperature transducer then makes an analog conversion from temperature to correction factor. A resistor network, used in conjunction with a 10-tap balancing slidewire in the digital converter mechanism, generates the 13 nonliner curves of temperature vs. correction factor. This correction factor is stored in the computer.

Tape Storage

A large data capacity is required for storing information for 88 tank-volume tables. This is best handled digitally by a magnetic-tape storage system. Each table lists volume vs. height in 0.01-ft. increments over an average range of 50 ft. Each volume requires five significant digits including those for checking purposes. Careful use of tape space permits all this information to be stored on one 14-in. reel of ⅝-in. seven-channel tape.

Computation

The first step in the computation is to find the section of tape containing the height vs. volume for tank being measured. The stepping switches set up the tank identification number and the tape mechanism is started in the forward direction. A tape transport control section serves to reverse, stop, and start the tape transport.

Buffer storage . . . The tape transport operates at 60 in. per second. Data appear at a greater rate than can be accepted by the multiplier. Thus a buffer storage is required to match high-speed tape transport with the lower-speed multiplier. The shift register is a magnetic-core memory device which stores the volume as read from the tape.

Error detection . . . Defects in tape, oxide inclusions, and other foreign matter may result in errors in the read data. Therefore, an error detector network for decimal digits is incorporated in parallel with the shift register.

Multiplication . . . With the correction factor registered on decade counters and the volume in a shift register, the computer is ready to multiply. Multiplication is based on parallel successive additions performed by an accumulator. The accumulator consists of seven decade tubes of which only the first five most significant are read out.

Printout . . . With the completion of multiplication, the accumulator holds the product of volume and correction factor. A stepping switch then scans the cathodes of the accumulator tubes to read out the product which is typed on the log sheet. Thus all information relative to one tank is printed out on one line. The stepping switches then advance and begin the cycle for the next tank.

3. TIDEWATER EXPERIENCE

All the logger systems at Delaware City are under contract maintenance. However, it is advisable that key operating personnel be able to correct minor system failures.

Experience has shown that the scanning function is a most valuable tool for the operator. An early problem was to determine the off-limit settings. Experience has now been accumulated so that up to 12 different sets of alarm limits may be preset, when required. Thus, if the crude-distillation unit is to change from one type of crude to another, the operator already knows which set of alarm limits to put in for a particular crude.

Trend recording has also been of value as a sort of short-term history on unit operation since it has enabled the operator to follow graphically, with high resolution, what has been happening on a given unit. It has also been of aid in making process design changes, along with the periodic log printout. Of course such use of graphical records is not new; but, as noted, the full-case records are available here, even though panel boards have been greatly reduced in size.

The visual digital indicator feature is valuable as a "magnifying glass" for the variables (any two) selected by the operator through the console jack panel.

It still depends on the man. Much depends initially on the attitude of the supervisor and the operators. A supervisor who has a great interest in the data logger, who likes to work with it, nurse it along through its initial teething period, will of course have a lot to do with its acceptance by operators as a useful tool. Some Tidewater supervisors have been learning new ways of using the system that the manufacturer did not think of. In the hands of these men the logger is a success. Also, it may become a valuable training aid for operators.

Under another supervisor with a negative attitude toward the logger during its initial "baby" period, it could become a failure or just a so-so gadget.

A survey made 6 months ago among Tidewater operating personnel indicated that the information system was doing a good job in most of the areas. It was appreciated as a time saver and operating aid by all who used it. However, not all areas were using the system to its maximum capacity. In those areas, such as the crude unit, where personnel has gone to work acquiring a good understanding and day-to-day know-how, the equipment is used effectively with 98% or higher efficiency.

This survey pointed up the need for: (1) more training of operators on their particular logger unit, (2) check of setpoints and deviations from range, (3) check on alarm limits, (4) setting up with manufacturer a check list whereby responsible operating personnel can find and correct minor system failures, and (5) placing on all units an information system log book for writing down all troubles and repairs, large or small.

It is of interest that one of the most remarkable increases in utilization factor was achieved by substituting key-lock switches for the scanner on-off function. Before this was done, operators had picked up the habit of turning off the scanning function during a serious process upset. The control of the key for this switch is now in the hands of the area superintendent. Again, this sort of experience is nothing new; it has been encountered before in the refinery when introducing a new technique. It is merely cited to emphasize, once more, the importance of the human element in successful operation of a process information system.

Commissioning the System

To assure smooth, efficient startup and acceptance of the equipment by the user, these steps are of extreme importance:

1. The system is first shop-tested (in vendor's plant) using inputs similar to those encountered in user's process. The system is checked out, being run on and off for about a week in a de-bugging period. This checkout test should be witnessed and certified by the user.

2. The equipment is then torn down and shipped to user complete with dummy inputs. It is erected at user's plant and checked with the dummy inputs to see if any damage has been incurred in shipment.

3. Commissioning now begins, employing the actual process inputs. The complete process measurement system is subjected to operation over a wide range of input values, so that the various instrument output readings may be reconciled for the same readings by indicator, recorder, and logger.

4. After the system has been commissioned, a routine maintenance procedure is established to assure high continuity of operation. It is important that a procedure be set up for readjustment of transmitters and receivers on the logger, in relation to the rest of the instrumentation system whenever changes are made—as, for example, when a flow meter range is changed.

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Reliability . . . It's an important factor

The trend is towards solid-state components—transistors and magnetic cores—for reliability. Other major factors for successful data logger installations are: (1) economic justification (2) serviceability, and (3) the human element.

BY HENRY S. STOVER
Beckman Systems Division

THE SUCCESS or failure of a data-handling installation may vary from one installation to the next according to the characteristics of plant and process.

• **But there are five basic questions** which, if adequately answered, will probably indicate whether a successful data-handling installation is possible:

1. Is this a bona fide application from a technical view?
2. Is there economic justification?
3. Is reliable equipment available to satisfy the application?
4. Can the equipment be operated and maintained by available personnel?
5. Have the human aspects of the installation been considered carefully?

• **The necessary hardware** to meet the requirements as to reliability of continuous-process application is available now. What is the nature of this hardware?

We must select components whose life is not a function of the number of times they are used, unless this number of times can be predicted accurately.

Components for data systems fall into three basic categories: (1) electromechanical components, such as a relay or slide-wire potentiometer, (2) vacuum-tube electronic components, and (3) the solid-state components, such as transistors and magnetic cores.

1. Electromechanical . . . We must very carefully consider the application of the electromechanical component, if such is used in the data system, since its life is a direct function of the number of times it is used. We must apply the electromechanical component where its total life expectancy divided by its use frequency is a time well in excess of the life expectancy of the complete system. Or, we must be able to predict very accurately when the electromechanical component will fail and thereby be able to replace it before it fails in service. Design to use this type of component as infrequently as possible.

2. Vacuum-tube component . . . The major concern in the use of the thermionic electronic tube is that of filament failure. Life is a function of length of time in use. Here again, we must either have filaments with a guaranteed life expectancy well in excess of the service life of the equip-

ment, or we must be able to predict accurately when this filament might fail so that we may replace the component before it fails in service.

We are able to predict what the average life of a large number of any type of component will be. But it is difficult to predict when we might experience failures in a data system where the components have been selected from stock at random.

3. Solid-state devices . . . And so it is desirable, wherever possible, to use the third type of component—the solid-state electronic device. The life of such a device is a function, not of the number of times it is used, nor a function of some such element as a filament. Rather, it is a component whose life can be expected to be indefinite as long as the component is used in a proper environment (temperature and humidity).

Trend Is to Solid-State Components

For reliability, the use of solid-state components must be stressed. That this is a wise design choice is being demonstrated daily in the data-processing industry. As each new design is offered, fewer and fewer vacuum tube and electromechanical components are employed and the trend is definitely toward the use of solid-state electronic devices.

Modular Design

A great deal of reliability also can be obtained by the use of modular design. Briefly, this means build a data system and a few basic functional circuits which can be put together to perform a wide variety of logical functions required in an automatic data system. By using only a few basic types of circuits, more engineering time can be devoted to each of the circuits and therefore more study can be given to the problem of reliability. Also, with fewer types of basic circuits, the problem of interaction between circuits can be given the necessary engineering attention.

Packaging

The system must be packaged so that all components are accessible for maintenance. It must be packaged so that all components are in an invironment compatible with their operating requirements. For instance, we must not locate the transformer in such a manner that it blocks the flow of air from the fan used to cool the transistors.

Serviceability

- **The manufacturer** would like to design his system so that a failure in the equipment would never occur. However, man has not yet, and probably never will, build a machine that will never fail.

Yet a machine can be considered reliable, if, when it fails, this failure is immediately announced. And it is possible, either through automatic means or some ready manual means, to get the equipment back in service before the lack of this equipment has caused serious process complications.

In data-handling equipment, it is fairly standard practice to build in certain self-checking features which will announce when some difficulty has occurred. However, this is only the first step. It must then also be possible for available personnel to interpret the status of the machine by some means of indication; and to be able to communicate with the machine effectively enough so that the trouble may be isolated and the faulty component replaced or repaired.

This may be accomplished by the use of the pinboards or other means which indicate to the service and operating personnel the machine instructions in common, everyday language. Also indicators, such as neon lights, may be placed throughout the system on the various elements to provide a means of communicating with the machine—asking it to perform a function and immediately determining whether or not the function has been performed properly.

Understanding the Equipment

Early data-processing equipment was provided with large banks of potentiometers with arbitrary scales which had meaning only to the engineers who had designed the equipment, or to someone who was highly skilled in electronics.

- **The trend in later designs** has been to provide data systems which present the system's functions to the operators in language which is used in the everyday life of an instrument man or plant operator. A common technique which is being widely adopted in the data-handling industry today for providing machine functions in process language is the pinboard programer. This, since it is an extremely effective means of communicating with the machine, also is a very valuable service tool.

The Human Factor

Probably the most important consideration for a successful data-handling installation is the human psychology involved when introducing the equipment into the process. Any new instrumentation technique is accepted into service with hesitation on the part of the operating people, the maintenance people, and quite often, the engineers themselves.

- **Management** is looking on the new investment with an economic eye.
- **Labor and operating people** are automatically concerned by any new device connected with automation.
- **Long before** its installation at the site, information should be disseminated on the data-handling equipment and its benefits to the various people in the plant.

Personnel Conditioning

The installation of a data-handling system in any plant is an opportunity for maintenance technicians to become familiar with a new technique that is going to be more and more prevalent in the future. They will be presented with an opportunity of staying abreast of modern-day technology.

The process engineers must be made familiar with the capabilities of the unit so that they will be thinking of new ways continuously to derive benefit from the use of the data-handling system. Only with personnel conditioning such as this can management expect to get an effective return on the investment put into a data-handling system.

Without the constant cooperation of the personnel who will be associated with the equipment, the data-handling system will fast become a forgotten monster typing away page after page of data which will never be read.

Here is a final word on personnel education. In a recent large system installation there were six typewriters involved in recording several hundred process variables. One of the biggest problems of this installation was not the operation of the data system, the reliability, or the justification, but the itinerant typewriter "key peckers" who would, out of curiosity, inject numbers making the log sheet almost unreadable. Typewriter covers with locks turned out to be the only solution to this problem.

The Author

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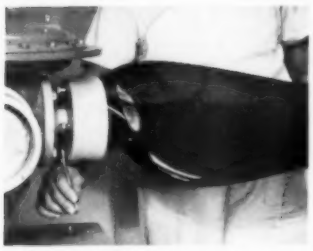

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Data-handling school provides a link between user and manufacturer

There is a new school holding classes these days. It is a data-handling system school set up by a manufacturer to teach the users. This school has benefited both user and supplier. The burden is on the manufacturer to set up the course with care especially with regards to amount of detail taught in a limited time. The user must exercise judgment in selection of personnel sent to this school.

BY MAYNARD KULJIAN
Beckman Systems Division

MANY TRAINING SCHOOLS were organized during World War II, under the impact of industrial mobilization, to upgrade personnel and train newly hired employes. The industrial-school idea has persisted and today is found in some new forms. An example is the data-handling systems school being conducted at Anaheim, Calif., by the Systems Division of Beckman Instruments, Inc. This is a streamlined course, set up to acquaint customer's personnel with a specific technique and a specific type of equipment.

- **Some complex hardware** goes into a data-handling system. This hardware is nearly useless without proper technical instruction; today the operating companies do not have a backlog of trained men qualified to operate and find new applications for the data logger.
- **Data acquisition, processing, and recording** systems are covered in the short-term school set up by Beckman specifically for users of its equipment.

Training Period

One of the problems associated with user training is the time involved. The customary duration has been 2 weeks on the larger systems. The expense, both to manufacturer and user, is significant; so is the time spent away from job and home by the customer's engineer, supervisor, or technician. For this reason, there should be a flow of information to the user antedating the actual school session.

Manufacturer-user correspondence . . . From experience to date, even 2 weeks has been inadequate to cover all the necessary ground. Therefore, a version of the correspondence school must be called on to supplement the actual 2 weeks of training. This is the systematic mailing of printed material to the user while he is still anticipating arrival of his system. He is glad to have the information in advance. As he begins to become acquainted with the logging equipment through a reading of this material, problems begin

to be formed in his mind and he can store these away in his mind for specific answer at the actual school later on. A basic foundation is laid for more detailed knowledge later, allowing the school to begin on a higher level than it could otherwise.

Number of personnel . . . It is desirable to have at least 8 to 10 people in a class—say 2 or 3 from each user company—so that a real class effort can be made. When a sizable group is involved the instructor feels inspired to do a top-notch job. Therefore school periods are timed so as to obtain at least this size of class. Another factor in the timing of school periods is to have one of the customer's loggers in test during the course. This provides live lab material to illustrate the lectures and give factory-fresh experience.

A typical service school course was the third one, given early this year, on the 112 data-handling system. There were three men attending from the Esso Baton Rouge refinery, two from the Du Pont Sabine River Works, one from Stone & Webster, and three from the Continental Oil Co. Ponca City refinery. A number of Beckman trainees also sat in.

The course was presented in the form of lectures punctuated freely by many questions from the class covering use of the equipment, the whys of certain design features, value of optional pieces of equipment, problems in system development, etc.

System features . . . First part of the course dealt with the system itself—explanation of system logic, drawing of the electronic circuitry, tracing of information flow, presentation of some trouble-shooting procedures. Each of the following sections of the 112 system were covered: (1) input circuits, (2) analog domain, (3) system timing, (4) digital domain, (5) output devices, (6) off-normal and alarm, and (7) power supplies. Thus this part of the course was largely on the system electronics, with the function, capabilities, and value of each component emphasized as each section was discussed. Roughly a day was spent on each of these sections.

Programing . . . Two days were spent on how information is processed by the logger and how to determine and pin the proper program for each input variable. (See Teed on pinhoard technique.) The logger, basically, takes input information in the form of a voltage, processes the information, converts the voltage to digital value, and presents the digital value through an output device such as a typewriter. The facilities for processing the information are wired into the system. The man doing the programing makes the choice of which processing facility to use or not to use, and of "scaling" each input voltage to give correct output digital value.

The final day and a half of the course were for review and questions and also for discussion of experience in installing a 112 system at the Sweeny refinery of Phillips Petroleum Co. (See Allen and Smith on the Sweeny logger.) Problems encountered when making this Phillips installation were largely in the physical handling of the equipment and union disputes as to who should do the work.

Advantages to the data-system user of sending several men to a training school such as this are obvious. There are also some hidden advantages to the manufacturer. It is one thing to understand a subject and another to teach it effectively. An instructor at the school really learns the system he is teaching and his imagination is stimulated by the many questions asked. He also gets to know the users' representatives better—their feelings and problems—which, in turn, leads to a better appreciation of the users' operations. Occasionally, the users' personnel may bring with them some bits of technical information that can lead to better data handling practice.

What Are Some Criticisms?

Two items in particular need emphasis under this head—one concerning the manufacturer and the other the user.

The criticism has been voiced that too often some portion of a course is taught in such detail that the students cannot see the forest for the trees. For example, if an automobile school were set up for students who had never seen an auto before, one would not begin with a most detailed lecture on the ignition system and engine timing. The fault may come about because the instructor himself may have had difficulty in learning the mechanics of certain portions of the data-handling system. When he finally achieves understanding of, for example, the timing section of the logger system and its importance to over-all operation, the tendency is to overemphasize it in teaching.

A second criticism is concerned with the caliber of people who are selected by the user to receive training. The problem is the same as in any classroom: there is usually a wide disparity of backgrounds. As far as the instructor is concerned, a class nearly equal in background and ability just couldn't happen! And yet it should—particularly where companies from a given industry are able to select the people they desire. Just one slow person will hold back the entire class. Companies that send people out for training should pick men who are well qualified both to learn **and teach.** They will be teaching as soon as they return.

The key to industrial training is the same as for any other schooling. It is still the problem of communication between two human beings. It is still the problem of trying to teach experience. With all the improvements in expediting, storing, and communicating equipment, the human barrier still remains as the greatest challenge in the application of new, progressive techniques.

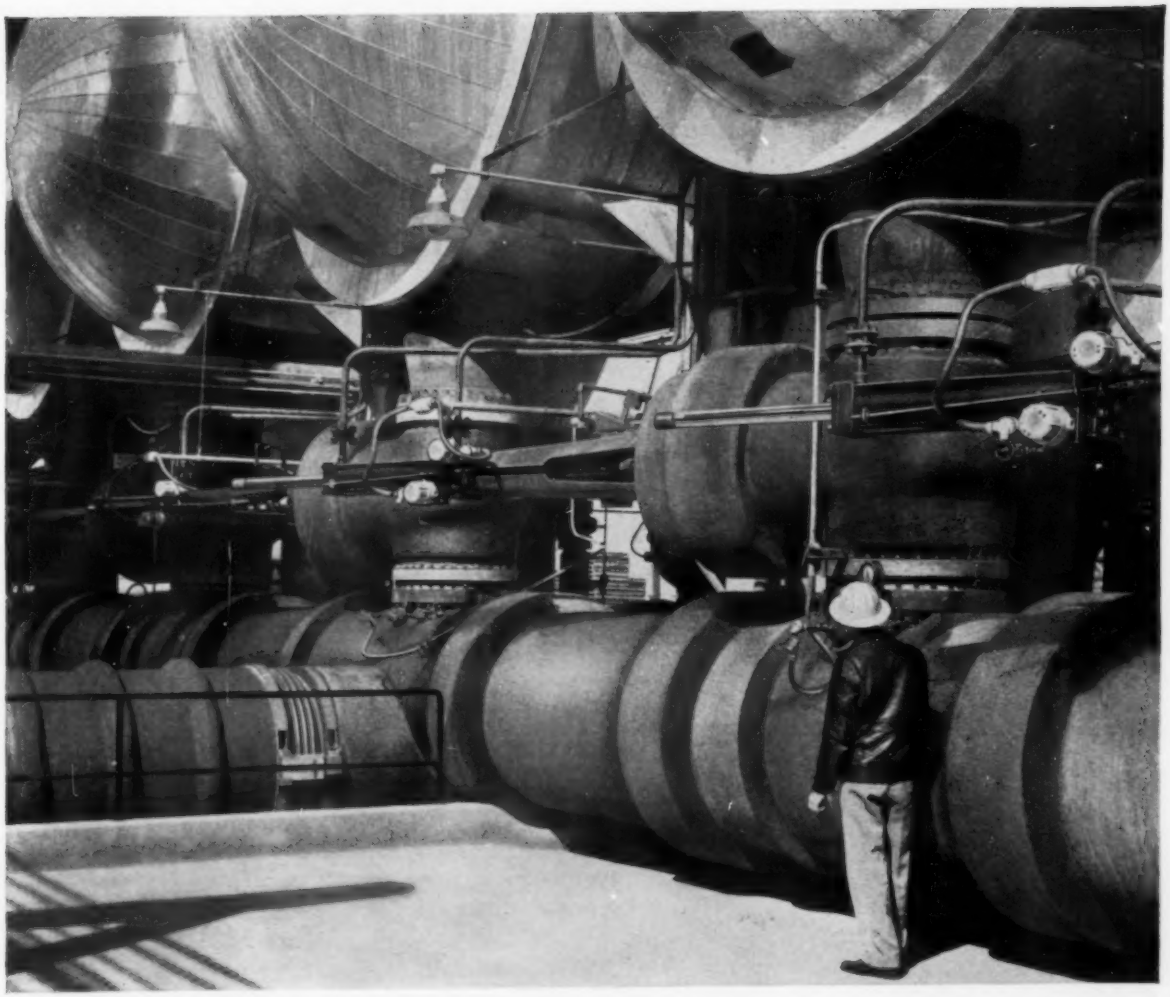
Pickup support aids heavy loading

R. N. RACKLEY, meterman for Houston Pipeline Co., and the men in the shop rigged up a support which can be carried in the back of a pickup truck and used when necessary for loading heavy meters, valves, and other material used in meter work.

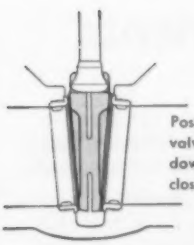
It consists of nothing more than a flat plate bolted to the bed of the pickup with a 2½-in. pipe riser welded and braced to one side. The pipe sticks up about 2 ft. and when it is desired to raise a load, a bent support made from 2-in. pipe is picked up from the bed of the truck and inserted.

The boom has an eye on the end and a comealong is carried which is hooked into the eye to make it easy to raise the load and swing it onto the truck.

As soon as the load is placed, the boom is picked out and laid back down in the bed of the truck.



Big valves on high-temperature ultra-frequent cycling service prove positive seating of Crane flexible disc



Positive seating principle of Crane flexible disc gate valves. Holds tight at both seat faces—*upstream* and downstream. Also overcomes sticking of disc when closed hot and opened cold.

16 months ago Texas Butadiene & Chemical Co., Channelview, Texas, installed 42 Crane 30-inch steel flexible disc gates as switch valves on the butadiene processing line in its new plant.

Each valve is installed *on its side*. Each is cylinder-operated on a cycle of 7 to 9 minutes—approximately 192 operations every 24 hours! Temperature ranges from 950° to 975° F., at 21 inches of vacuum to atmospheric pressure.

After 16 months of this constant, tough service, all 42 of these 30-inch Crane valves continue to operate freely, smoothly—with not a sign of leakage on either *upstream* or downstream side of the flexible disc!

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Checking humidity control setting in one of Ethyl's controlled-weather rooms

Ethyl Research reports the effects of temperature and humidity on fuel road ratings and octane number requirements

ETHYL Corporation's policy of keeping significant research data up to date and usable has produced a new study of the influence of weather and associated engine variables on fuel road performance and engine octane needs.

Refiners can use the results of this study to evaluate the effects of weather on the high-octane fuels they are producing for the high-compression engines of today.

In 1953 a similar study was conducted by Ethyl engineers. The results were published in an S.A.E. paper entitled, "Weather or Knock." The increase in compression ratios and the accompanying rise in octane numbers made it necessary to up-date the earlier research.

In the 1953 tests, cars with compression ratios of from 6.5-to-1 to 7.5-to-1 were tested on fuels ranging from 81.1 to 92.6 RON. This year, fuels from 96.6 to 99.8 RON were used in 10-to-1 compression ratio cars.

Conditions of the 1958 Test Program

The octane number requirements of two test vehicles were determined in terms of primary and commercial reference fuels at a number of combinations of ambient air temperature and absolute humidity.

Road ratings of six test fuels of various hydrocarbon compositions also were studied at these combinations. (See Tables I and II.)

Fuels were selected to represent a cross-section of commercial fuels now available. The Modified Borderline procedure was used in order to show the change in behavior characteristics throughout the engine speed range.

Road ratings were determined in duplicate on a chassis dynamometer in one of Ethyl's controlled-weather rooms at each of the selected conditions of ambient air temperature and absolute humidity shown in Table I.

Summary of 1958 Tests

The following general observations were made on engine octane number requirements (ONR) and fuel road ratings:

ONR increased when absolute humidity was held constant and the ambient air temperature was raised.

ONR decreased when ambient air temperature was held constant and the absolute humidity was increased.

Road ratings of test fuels decreased when the absolute humidity was held constant and the ambient air temperature was raised.

Road ratings of test fuels varied with changes in absolute humidity at constant ambient air temperature depending upon the temperature level and the hydrocarbon composition of the fuels.

It is important to relate the foregoing conclusions in terms of increase or decrease in the ability of a fuel to satisfy engine octane requirements.

With ambient temperature increase and constant humidity, the "satisfaction ability" decreases. "Satisfaction ability" increases with an increase in humidity when ambient air temperature is constant.

Comparison of Old and New Data

Data from the 1953 and 1958 programs agree directionally on the effects of temperature and humidity on octane number requirements, but differ in the magnitude of the change.

With respect to changes in fuel road rating, the new data do not agree with the data in the "Weather or Knock" paper where highly olefinic fuels are involved.

TABLE I

Ambient Air Temperature, °F.	Absolute Humidity — Grains of Moisture/lb. of Dry Air
90	160, 119, 78, and 30
60	78, 57, and 30
35	30

TABLE II

Test and Commercial Reference Fuels

	TEST FUELS						COMMERCIAL REFERENCE FUELS		
FUEL NUMBER	A	B	C	D	E	F	A[1]	B[1]	C[1]
Research ON	97.0	97.3	99.0	99.8	96.6	98.0	96.0	98.0	100.0
Motor ON	83.3	85.4	89.0	86.9	87.2	87.0	85.8	86.8	88.9
Sensitivity (RON-MON)	13.7	11.9	10.0	12.9	9.4	11.0	10.2	11.2	11.1
TEL, ml/gal	2.67	3.0	1.49	0.97	1.49	3.00	1.37	1.43	1.77
Hydrocarbon Type, Vol %									
Olefins	34	42	4	22	5	24	14.7	14.5	12.1
Aromatics	12	14	43	35	39	22	33.8	36.2	39.1
Saturates	54	44	53	43	56	54	51.5	49.3	48.8

How Ethyl Research is helping you

The work described here is one more example of Ethyl's service to the refiners by keeping them informed of latest developments pertinent to the fuel-engine relationship.

The complete report made of this study is available through your Ethyl Representative.

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RESEARCH LABORATORIES:
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BY W. L. NELSON, Technical Editor and Petroleum Consultant

Process-unit maintenance

THE GREAT VARIATION in maintenance costs is due mainly to the following factors which can be weighted somewhat as follows:

Corrosion	*0.5 to 2
Severe corrosion	3 and up
Erosion	0.5 to 1
Temperature	0.5 to 1
Pressure or vacuum	0.5
Small (or cheap) plants	0.5 to 1
Machinery or instruments	0.5 to 1

*Ordinary plants.

The maintenance cost as percentage (per year) of the replacement value of the plant is approximately equal to the sum of the several factors plus 2.0 (see tabulation).

Corrosion and erosion obviously necessitate repair or replacement costs. High temperature leads to oxidation or rusting, and pressure or vacuum requires more frequent inspection and a larger factor of safety. The effect of complexity as a factor is somewhat eliminated by the use of a percentage basis, however, instruments and machinery (compressors, filters, elevators, etc.) require extra maintenance. Likewise the maintenance of cheap or small plants is somewhat larger because the cost of maintenance labor is relatively high.

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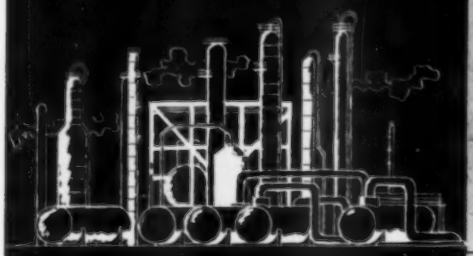
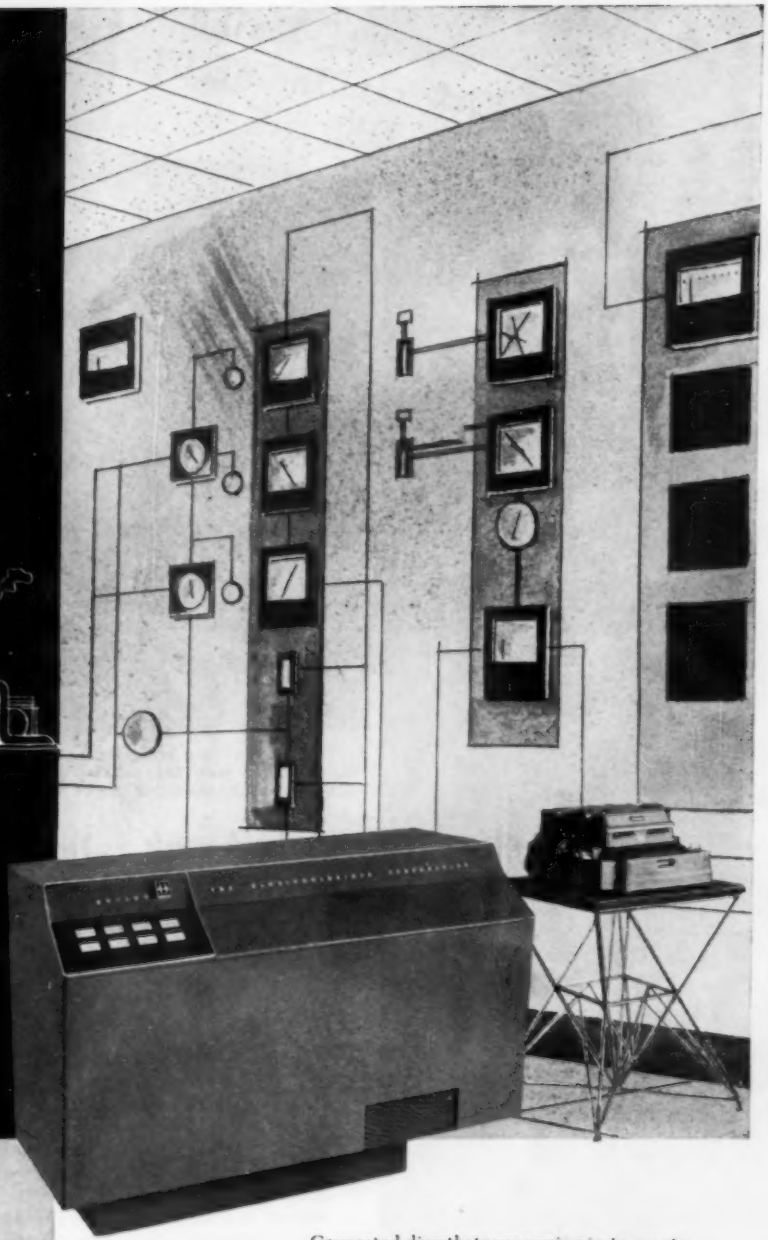
	Maintenance, per cent of replacement value per year				Cost factors in maintenance						
	Estimated										
Process—	Suggested	by points	Literature*†	Range†	Corrosion	Erosion	Temp.	Press. or vac.	Machinery or instrument	Small or cheap	References
MEK dewaxing	2.4	2.5	2.15 (1)	...	...	...	...	...	0.5	...	1
Water cooling	2.8	3.0	2.77 (85)	0-11	0.5	...	...	...	...	0.5	2-5
Natural gasoline	3.0	3.0	3.2 (12)	1.7-9	...	...	...	...	1.0	...	6, 7
Propane deasphalting	3.2	3.0	3.5 (2)	2.7-4.2	...	...	...	0.5	0.5	...	1, 8
Vacuum distillation	3.3	3.0	3.8 (2)	3.5-4.0	...	...	0.5	0.5	...	...	1, 8
Solvent extraction	3 to 5	3 to 5	4.9 (4)	4.0-6.5	0.5-2	...	...	...	0.5	...	1, 9-11
Atmospheric and vacuum distillation	4.0	3.5	4.7 (3)	4.3-5.5	1.0	...	0.5	...	...	...	1
Clay burning	3.5	3.5	3.7 (3)	1.7-5.6	...	0.5	1.0	...	...	...	12
Hypersorption	4.0	4.0	4.0 (1)	.....	...	1.0	...	...	1.0	...	14
Lubricating oil	4.0	4.0	5.0 (1)	.....	1.0	...	0.5	...	...	0.5	15
Desalting	4.0	4.0	5.65 (1)	.....	1.0	...	...	0.5	...	0.5	16
Crude distillation or topping	4.5	4.0	4.8 (8)	2.0-6.6	1.5	...	0.5	...	...	...	1, 17
Catalytic cracking	4.5	4.5	4.3 (24)	1.4-8	...	1.0	1.0	...	0.5	...	1, 7
Catalytic reforming	4.5	4.5	4.4 (8)	2.7-6	1.0	...	1.0	0.5	...	...	18-25
Viscosity breaking	4.5	4.0	5.0 (1)	.....	1.0	...	1.0	...	...	...	8
Topping and thermal cracking	4.5	4.5	3.8 (2)	2.0-5.4	1.5	...	1.0	...	...	...	1, 13
Topping and coking	4.7	4.5	3.2 (1)	.....	1.0	0.5	1.0	...	...	...	1
Catalytic desulfurization	4.6	4.5	4.8 (8)	2.0-6.2	1.0	...	0.5	0.5	0.5	...	18, 26-32
Copper chloride treating	5.0	5.0	7.75 (1)	.....	3.0	...	...	...	...	...	33
Coking	5.2	5.5	5.0 (6)	3.2-7.2	1.0	1.0	1.0	...	0.5	...	1, 34-36
Polymerization	5.3	5.5	5.1 (11)	2.5-7.3	1.0	...	0.5	0.5	0.5	1.0	1, 37
Thermal cracking or reforming	5.5	5.5	5.3 (6)	2.3-7.3	1.0	0.5	1.5	0.5	...	...	1
Alkylation	5.7	5.5	5.9 (22)	3.2-6.7	2.0	...	...	...	0.5	1.0	1, 27, 38, 39
Petrochemical	...	...	4.8 (19)	1.5-12	...	...	...	...	...	...	7, 40-51

*Numbers in parentheses indicate number of plants or estimates of plants contained in averages. †Estimated values (by contractors, etc.) in the literature were raised by one-third.

advanced data logging



...with the RW-300 digital control computer

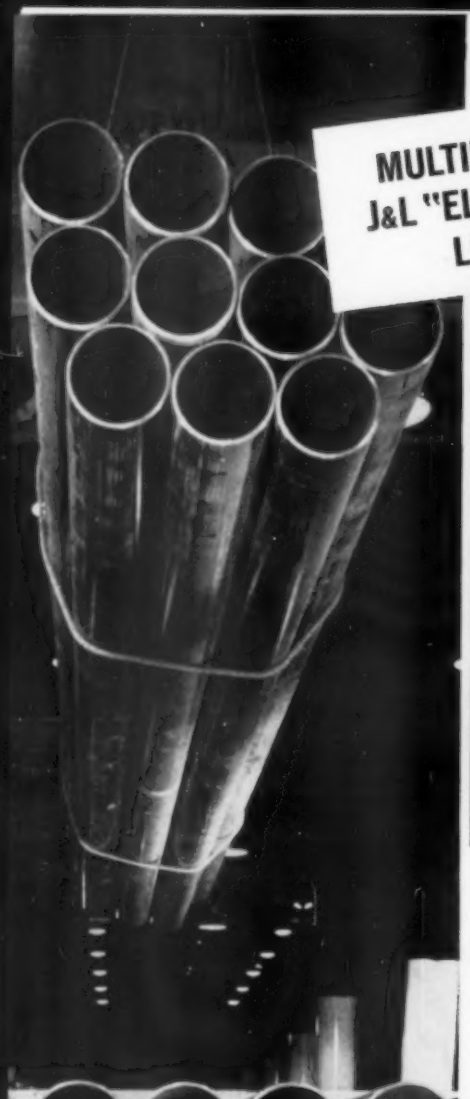


The Ramo-Wooldridge RW-300 Digital Control Computer—the first digital computer designed specifically for automatic on-line process control and data logging—offers significant advantages as the heart of advanced data logging and scanning systems for oil refining, chemical, and other process industries. Unlike conventional data loggers, the RW-300 can be converted to completely automatic control through a minor field modification without purchasing expensive additional equipment and without scrapping any part of the existing logger.

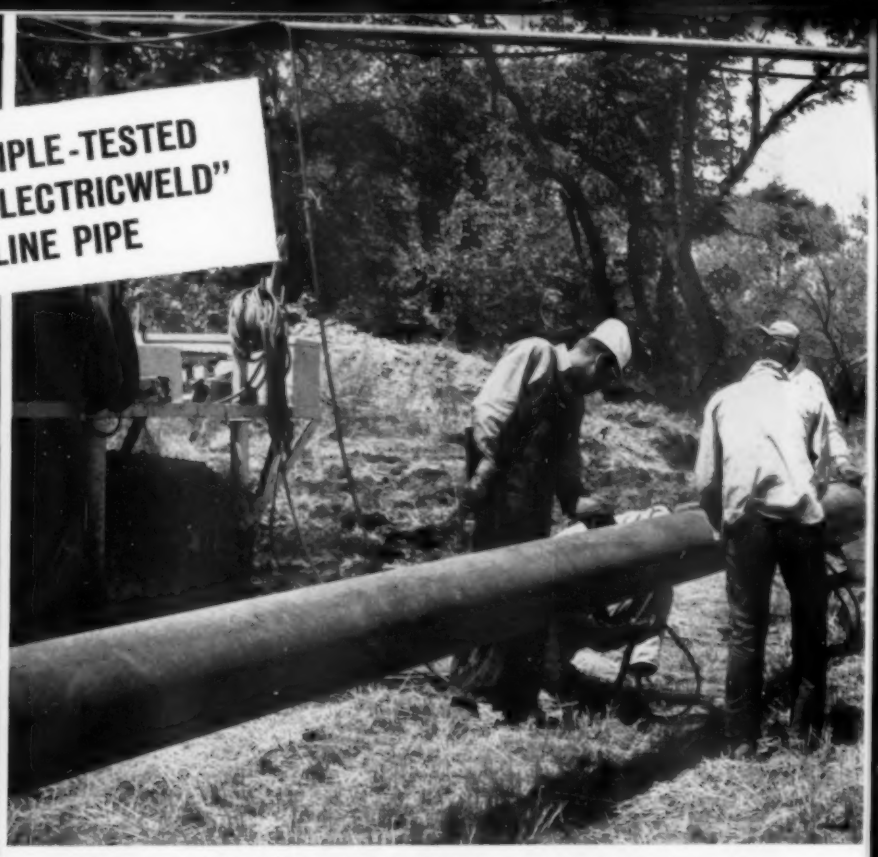
Connected directly to measuring instruments, the RW-300 can do more than log raw or partially processed data. It can also compute and immediately print out more meaningful information such as yields, conversion efficiencies, and energy balances. The RW-300 can also calculate operating guides for plant personnel to follow. In addition to checking process variables against upper and lower limits, the RW-300 can perform more sophisticated checks on process equipment and the process itself. These checks reduce plant maintenance costs by detecting faulty operation of the process in time for corrective action.

For technical information on automatic process control and advanced data logging with the RW-300, write: Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, P. O. Box 45067, Airport Station, Los Angeles 45, California, or call OSborne 5-4601.

THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY



MULTIPLE-TESTED
J&L "ELECTRICWELD"
LINE PIPE



Welders on this Jayhawk Pipe Line Company installation report J&L Electricweld pipe is easy to weld. They installed 3109 tons of 10¾-inch O.D. and 3172 tons of 12¾-inch O.D. Electricweld pipe in this line. Both sizes are in .250 inch wall and Grade X46.

Jayhawk relies on J&L "Electricweld" line pipe for 78 miles of dependable performance

The Jayhawk Pipe Line Company, Wichita, used 42 miles of 10" and 36 miles of 12" J&L Electricweld line pipe in this new line from Plains to Valley Center, in Kansas. They find that J&L Electricweld line pipe bends readily, is uniformly round, is consistently top quality.

Electricweld line pipe is produced by Jones & Laughlin under most rigid quality controls. J&L, an integrated steel company, is able to control quality from ore through finished pipe. J&L takes every step to assure unsurpassed quality and dependability in Electricweld.

Before welding, the skelp edges are blasted with steel grit under 100 psi in a "Vacu-Blast" unit to clean the surface for perfect contact with the welding electrode. Electronic controls maintain exact welding heats at all speeds. After welding and trimming, the pipe passes through an induction annealing unit to assure uniform grain structure in the weld area.

Every length is thoroughly inspected through visual examinations, hydrostatic tests, flattening tests and magnaflux examinations. All J&L Electricweld line pipe is manufactured and tested in strict compliance with appropriate A.P.I. and A.S.T.M. specifications.

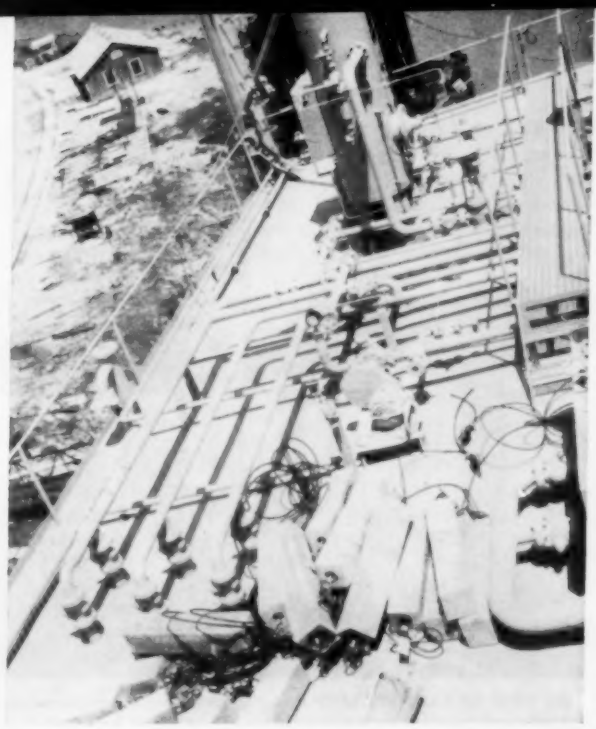
Electricweld line pipe is available from 6⅝ inches through 12¾ inches and in lengths to 60 feet. Investigate this superior-quality pipe for your next line. See your distributor, or write to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pa.

J&L STEEL

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

END VIEW OF TANK BATTERY before sinking. Ballast barge columns, barge bumpers, boat landing and oil-storage compartments are visible.



PARTIAL VIEW OF UPPER DECK showing some of the anodes before installation. Oil and gas separator is in the background.

PRODUCTION

How CATC fights marine corrosion

. . . *in an offshore mobile tank battery*

BY R. M. ROBINSON
Continental Oil Co.

CATC's Tank Battery No. 2 in West Delta Block 84 field has been given the full treatment to prevent corrosion. Protection was necessary for all parts of the battery to prevent:

1. External corrosion of the submerged parts.
2. External corrosion in the splash zone.
3. External corrosion in the atmospheric zone.
4. Internal corrosion in the ballast tanks.
5. Internal corrosion in the oil storage tanks.

The unit . . . Tank Battery No. 2 is a mobile unit of Bethlehem Steel Co. design. It includes a lower barge or hull that is 59 ft. wide, 112 ft. long, and 4 ft. deep. This hull contains four rectangular ballast tanks. There are 12 columns 44 ft. high to support the oil-storage tanks. These tanks hold 1,500 bbl. each and are fabricated to form a single unit 39 ft. wide, 72 ft. long, and 13 ft. high. Equipment for separation, measuring, and testing is placed on top of the storage tanks. A cantilever deck 30 by 39 ft. on one end of the tank area supports the generator building and pumper doghouse.

The battery was installed in April 1956 and now serves six Miocene-sand completions, all producing sweet crude.

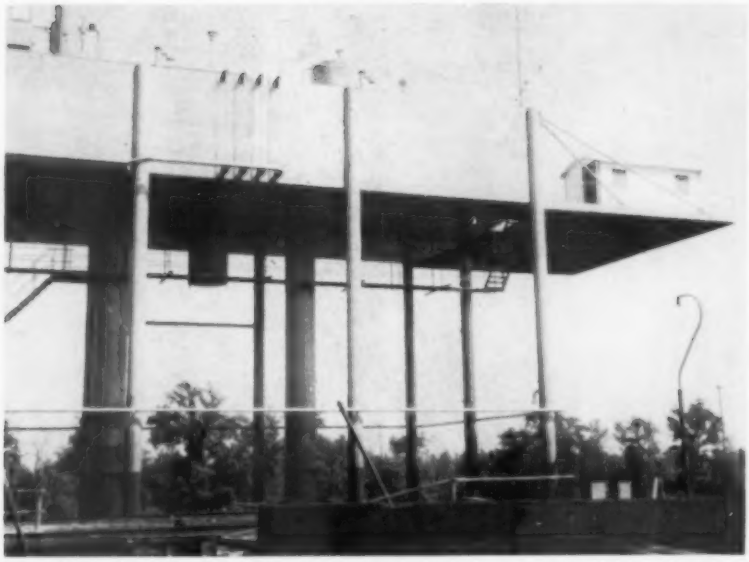
The ballast tanks were designed so that when empty the battery will float. The battery was floated to the desired location and the ballast tanks filled with water, allowing the battery to sink until the lower hull rested on the bottom. The lower hull was sized so that it spread the weight of the battery over a large area to prevent further sinking when the storage tanks were completely filled with salt water.

The battery is equipped with pumps which can be used to pump salt water for fire control or to fill empty storage tanks for added weight during storms. Rain water is caught in two of the columns for use in periodically washing down the battery.

A review of the battery reveals that it is exposed to both external and internal corrosion. The control methods used to combat these two types of corrosion will be discussed separately in the interest of clarity.

External corrosion . . . External corrosion results from the marine environment in which the tank battery is located. The battery is exposed to the same general corrosive conditions as steel piling standing in sea water.

Weighed samples from actual pilings and coupon exposures on offshore platforms have indicated three distinct zones of corrosion attack. These are the submerged zone from about 5 ft. below the mud line to about 2 ft. below mean low water, the splash zone from this height to 6 or 8 ft. above mean low water, and the atmospheric zone above this level. Corrosion rates in the three zones have been found to be 5 to 10 m.p.y. below water, 25 to 40 m.p.y. in the splash zone and 3 to 5 m.p.y. in



SIDE VIEW OF TANK BATTERY showing sump tank, cantilever deck, pumpers' doghouse, and production equipment.

the atmospheric zone when inadequate corrosion controls are maintained.

The corrosion in the submerged zone is attributed to galvanic corrosion around welds or small differences in the metal, solution of steel resulting from stray currents and reaction between the steel and chemicals in the sea water. The corrosion in the splash zone results from galvanic action between small differences in the metal, and because of potential differences at different heights caused by varying oxygen concentrations. Corrosion in this zone is aggravated by mechanical damage from floating equipment or debris. Corrosion in the atmosphere zone results from reaction between oxygen in the air and the steel in the presence of salt spray or water condensed from the humid atmosphere.

Past experience shows that cathodic protection alone is most suitable for the submerged zone and that barrier coatings are best for the other two zones. In order to make the corrosion controls effective and to assure that no built-in corrosion problems would exist, the design of the battery was reviewed with the construction people prior to accepting the final design.

The submerged portion of the battery was reviewed in order to eliminate as many blind spots as possible. This was necessary since cathodic protection is a line-of-sight type of protection and is most effective for areas which can be "seen" by the anodes. That is, areas to which a straight line can be drawn from the anodes without intersecting an obstruction.

As corrosion is most severe in the splash zone, this zone was analyzed to insure that the surface area was reduced to the bare minimum for adequate safety. Also, it was determined that boat landings, barge bumpers and guard rails were properly located to provide the necessary protection for the corrosion controls. The latter was of considerable concern in this instance as the oil would be barged from the battery for an indeterminate period requiring that barges be tied alongside the battery for loading operations.

The atmospheric zone was reviewed with the thought of reducing the exposed area to a minimum and to eliminate all hard-to-coat areas if possible. All stiffeners for the tanks were placed inside and cover plates and seal welds were specified where warranted. Piping and deck fittings were raised sufficiently to allow easy access beneath them for coating maintenance, and the upper deck was cambered to prevent water from standing on it. All handrails, fencing, and other small items were hot-dip galvanized.

After the design had been reviewed, a galvanic-anode cathodic-protection system was selected for the submerged zone. This area was not coated as past experience showed that coatings for underwater surfaces were not justified for such stationary items offshore. A total of sixteen 150-lb. magnesium anodes was used. These anodes were attached to the bottom of the storage tanks by means of galvanized wire rope which also served as the anode leads. Eight of the anodes were suspended in the water above the top of the bottom barge and the remaining eight anodes were equally spaced, four on either side of the lower barge, and about 40 ft. away from the sides of the barge. The latter anodes were allowed to sink into the mud and their cables were anchored with 100-lb. concrete pads in order to prevent fouling of the cables in screws of attendant boats. The anode connections were located for ease in installation and future maintenance.

It was estimated that the 16 anodes in the low-resistivity sea water would initially supply an average output of 7 amp. per anode for a total of 112 amp. This would provide an average current density of 6.6 ma. per sq. ft. for the 17,000 sq. ft. of submerged area. The output of the individual anodes would decrease as the metal became polarized with resultant increase in the anode circuit resistance. However, it was expected that the steel would reach a protective potential of —0.80 volt relative to a calomel electrode within a period of 4 to 6 weeks and that this potential would be maintained by the original anodes for 2 to 2½ years.

The flow lines from the individual wells were electrically isolated from the tank battery in order not to place an undue drain on the cathodic-protection system for the battery.

Splash-zone protection . . . The corrosion rate of 25 to 40 m.p.y. in the splash zone indicates that the application of expensive, long-lasting protection is justified. Consequently, monel sheathing was selected for this area. The corrosion rate for this material in marine-splash environment is such that 18-gage welded sheathing should last for 35 to 50 years. Further, this material is less subject to mechanical damage than other barrier coatings would be.

The monel was applied from 2 ft. below to 6 ft. above the expected mean low-water level. It was welded in place and pressure tested to assure that there were no leaks in the weld seams.

Atmospheric zone . . . This region also required a barrier-type coating.

THE AUTHOR

Robert M. Robinson is senior production engineer for Continental Oil Co., Houston. He has been with Continental since 1954 doing corrosion and production-engineering work in offshore operations. He was engaged in corrosion control work in Kansas and Oklahoma for Shell Oil Co. from 1950 to 1954. Robinson holds an M.S. degree in chemical engineering from A. & M. College of Texas.

but something less expensive than monel. The following properties are required:

1. Must be resistant to marine environment, oil and grease, abrasion from foot traffic, accidental blows with tools, and sunlight.
2. Must have sufficient application latitude for applying under adverse ambient conditions.
3. Must be quick drying.
4. Must have a nonpermeable film that can be economically maintained.
5. Must have a fire-retardant dry film that is pleasing in appearance.
6. Must be economically priced.

Various types of coatings now marketed were investigated, and it was decided to use a five-coat modified vinyl-chlorinated rubber system. The metal parts were sandblasted to remove mill scale, rust, and other foreign material, followed by an acid prime coat. This prime coat, applied to prevent early rusting, was followed by two "build coats" containing an inhibited pigment and flake mica to provide a thick film. The fourth coat contained flake mica and fibrous asbestos to increase the film build and increase abrasion resistance. The last coat was a thin film coat to bind the coating system together, provide a smooth easily cleaned surface, and impart the desired color.

Light gray was chosen as the final color because of its ability to reflect sunlight and reduce evaporation losses, and to make rust spots readily visible.

The particular coating system selected has exhibited a thixotropic nature, so that it covers better than some coating systems on edges and rough welds. This property has proven to be very important offshore for coating welded-steel structures such as the subject tank battery.

Before preparing coating specifications for the battery, the unique problems involved in coating the various items were considered. It developed that sandblasting could not be done on the piping, valves, etc., without incurring serious damage, yet these equipment items required protection. The flange fittings, which were used in order to allow flexibility of the piping system, would also be damaged by the sandblasting.

In order to overcome this difficulty, the storage tanks, columns above the monel, and all other areas below the main deck to be painted were sandblasted and given the full coating system before installing the producing equipment and piping. The main deck was also sandblasted, but it was coated with the first three coats of the system only. The production equipment and piping were then installed on the main deck. Three coats of the coating system were required to assure adequate protection of the sandblasted surfaces during the interim.

After the production equipment and piping were in place, all equipment which had not previously been sandblasted and all areas where the coating had been damaged were power wire brushed to remove all loose scale, rust, old coating, etc., and coated with a vinyl primer especially adapted to this purpose. These areas were then given the second and third coats of the regular system. Two complete wraps of polyvinyl chloride tape were placed around each flange to make coating effective. Following the application of the tape, the final two coats of the coating system were applied to the main deck, production equipment, and piping, completing the painting of the tank battery. This also completed the external controls for the battery.

Internal corrosion . . . The battery has three general internal areas exposed to attack by corrosion. These are: (1) the ballast compartments subjected to corrosion from the brackish water used to sink the battery; (2) the production equipment exposed to corrosive attack from the produced fluids; (3) the storage compartments also exposed to the production.

It was not considered feasible to use cathodic protection on the ballast compartments because of mechanical problems. For this reason, chemical inhibitors were chosen. Brackish water was used in the compartments to sink the barge, and sufficient potassium dichromate and sodium hydroxide were added to the water to provide 500 p.p.m. chromate ion and to raise the pH to 9.5-10.0. Past experience has shown that this method is very effective.

Protection of the production equipment was not a difficult job. Oil produced from corrosive wells reached the tank battery with a sufficient carryover of inhibitor, so that no further treatment was anticipated. Periodic checks by Audigage and Reflectoscope thickness surveys would indicate the need for any additional treatment at the tanks. A cathodic-protection system for the water compartments of the separating equipment will be installed if necessary.

The primary corrosion problem in storage tanks handling sweet crude results from produced salt water lying on the bottom. In order to obviate this problem the battery was equipped with a sump tank. This tank allows the gager to draw off all b.s. and w. from the storage tanks at regular intervals. The walls of the storage compartments will be dependent for protection upon chemical inhibitors added elsewhere in the system. The storage compartments will be visually inspected internally, as the need is indicated, to determine the effectiveness of these corrosion-control measures.

A corrosion-control program for an equipment item is not adequate unless continued vigilance is maintained to assure that all controls remain effective. Therefore, a routine inspection program has been established for Tank Battery No. 2. The water-to-steel potential is checked with a calomel electrode every 3 months to determine that the anodes are sufficient. The coating is inspected each 6 months and recommendations are made concerning needed touchup work. Minor coating work on the main deck is done by the pumpers or roustabouts, but the major coating work is accomplished with contract paint crews. Detailed inspection records are maintained in order that the necessary repair work can be accomplished.

As noted earlier, metal thickness surveys of pressure vessels and production equipment on the battery are conducted. The present schedule for these surveys is once each 6 months. The internal condition of the storage tanks is checked by visual inspections of the expansion trunk and walls during routine gaging or thiefing of the tanks.

Cost . . . The first costs of corrosion controls for the battery are given below:

Chemicals for water	$175
Cathodic protection	1,400
Monel sheathing	3,400
Coating	7,543
Vinyl tape	800
Total cost of initial corrosion controls	$13,318
Per cent of total installed cost spent for corrosion controls	6+%

Experience has indicated that the coating system selected for this tank battery when well applied can be maintained over considerable periods for approximately $0.15 per sq. ft. per year including initial application cost. Based upon the expected 2 to 2½-year life of the anodes the cost for cathodic protection will approximate $0.04 per sq. ft. per year. Little or no maintenance should be required for the monel sheathing.

Acknowledgment

The writer expresses appreciation to the management of Continental Oil Co. for permission to prepare and present this article, and to Earl D. Gould, of Continental Oil Co., for the assistance he gave in collecting data for its preparation.

New two-way process sweetens gas and recovers sulfur

THE "Townsend Process" is a new development for sweetening sour gas and effecting simultaneous conversion of its hydrogen sulfide content to elemental sulfur. Based on a reaction mechanism discovered by Dr. F. M. Townsend, this process has been developed to the pilot plant stage.[1]

Some of its principal features are:

- Simultaneous gas sweetening and sulfur recovery.
- Insensitivity to carbon dioxide in the process-gas stream.
- Effective dehydration of the residue gas.
- Highly flexible and easily adapted to a complete range of hydrogen sulfide concentration in the process-gas stream.
- Recovery efficiency may exceed 95% in sulfur-recovery operations.
- The process may be designed to replace the Claus process in converting acid gases from amine-type gas treaters. It is especially effective where carbon dioxide and/or heavy hydrocarbon contents of these mixtures are excessively high.

Process reactions . . . The oxidation of hydrogen sulfide to elemental sulfur may be considered to take place in two steps as follows:

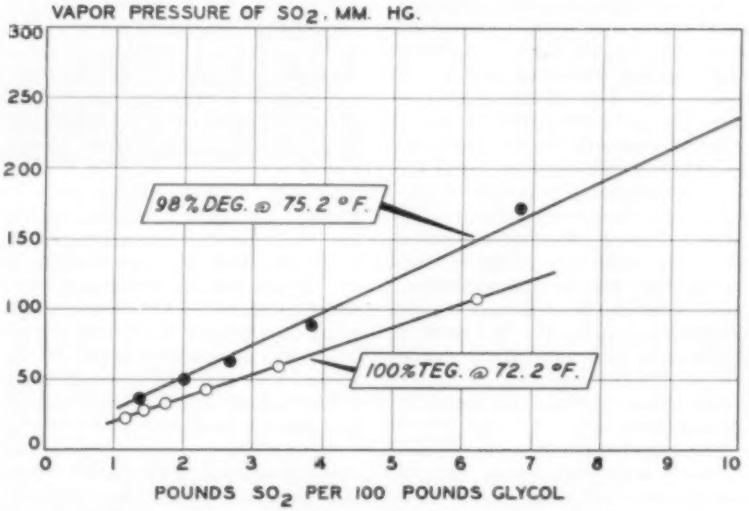
$$H_2S + \frac{3}{2} 0_2 = SO_2 + H_2O \quad 1$$

$$2H_2S + SO_2 = 3S + 2H_2O \quad 2$$

$$3H_2S + \frac{3}{2} 0_2 = 3S + 3H_2O \quad 3$$

Like the Claus process, the Townsend process employs reaction (2). Exothermic in character, the heat of reaction is —56.2 kilocalories and the free energy change is —26.0 kilocalories at 25° C. Gamson and Elkins[2] have studied the thermodynamics and kinetics of the over-all reaction (Equation 3) above and have shown that a catalyst is required at temperatures less than 730° C., that the equilibrium conversion of hydrogen sulfide to sulfur is approximately 95% complete in the catalytic range below 300° C., that conversion approaches 100% at atmospheric temperature, and that rate of reaction varies directly with temperature in this range.

Also, this work shows that an increase in operating pressure increases equilibrium conversion at any prescribed temperature in the catalytic range. The findings of Gamson and Elkins for the over-all reaction should apply to reaction (Equation 2) also. These reaction characteristics are used to good advantage in the Townsend process.



SOLUBILITY of sulfur dioxide in concentrated glycol-water solutions. Fig. 1.

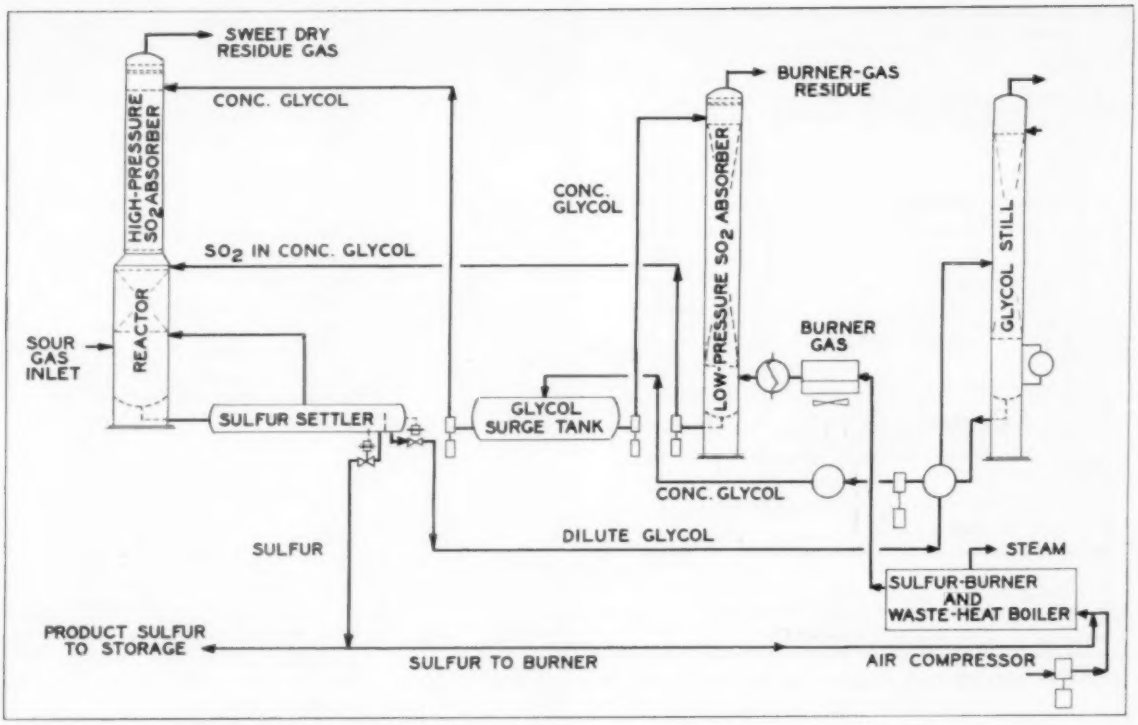
New process features . . . Unlike the Claus process and its modifications, the Townsend process employs a hygroscopic organic liquid, with no more than 10% by weight water in solution, as the catalyst and reaction medium. A large number of hygroscopic organic liquids can be used with success, but triethylene— or diethylene glycols are preferred because of low vapor pressure, high hygroscopicity, thermal stability and availability.

The reaction takes place at the gas-liquid interface. Sulfur forms in finely divided particles and mixes with the liquid to form a slurry. Studies of the reaction indicate that water is the catalyst and that the rate of reaction is inversely proportional to water concentration in the organic liquid solution. Since water is a reaction product, sufficient glycol is introduced to maintain water concentration at low level; preferably from 2 to 5%.

Sulfur dioxide is employed in slight excess to insure conversion of all hydrogen sulfide. Sulfur dioxide is readily soluble in the glycols, so that sulfur dioxide-free solution is employed to recover excess sulfur dioxide from the residue-gas stream. Some typical data on the solubility

BY LAURANCE S. REID and F. MARK TOWNSEND
School of Chemical Engineering, University of Oklahoma, Norman

Presented at the Rocky Mountain Regional meeting of the Natural Gasoline Association of America, September 18, 1958.



PIPELINE GAS SERVICE flow diagram for Townsend sulfur-recovery process. Fig. 2.

of sulfur dioxide in diethylene— and triethylene glycols are shown in Fig. 1. This solubility behavior of the solution is useful as a means for introducing sulfur dioxide into the system, particularly where the process is designed to produce merchantable residue gas.

Sulfur is essentially insoluble in glycol and may be separated and recovered from the slurry by a variety of methods. Obviously, continuous operation is highly desirable and easily attained in several variations of the process.

Processing Gas for Pipeline Sale

A typical application of the Townsend process is shown in Fig. 2 where, in addition to recovering sulfur from sour gas, it is desired to produce sweet, dehydrated residue gas for pipeline sale. Referring to this diagram, sour natural gas enters the lower portion of the reactor at line pressure and atmospheric temperature and rises through the reactor column where it is contacted by a descending stream of 98% glycol containing the proper amount of sulfur dioxide, which is pumped into the top of the reactor.

Upon contact between the gas and liquid phases, the reaction is virtually instantaneous; sulfur and water are formed. The sulfur is insoluble in the glycol but the water is absorbed. Glycol is used in sufficient quantity so that water concentration increases to but 5% by weight or less after absorbing all water produced by the reaction plus the water vapor content of the inlet gas.

Sweetened gas rises from the reactor and carries with it some excess sulfur dioxide. This mixture enters the base of the high pressure absorber where it is contacted by a descending stream of concentrated, sulfur dioxide-free glycol which is introduced at the top of the column. This solution absorbs the excess sulfur dioxide and remaining water vapor in the gas and passes downward into the reactor as shown. Sweet, dry residue gas passes from the top of the absorber.

Temperature gradient . . . The exothermic reaction and the counterflow design of the reactor combine to produce temperature gradient in this vessel which increases toward the base. Recalling the findings of Gamson and Elkins, cited above, rate of reaction is highest at the relatively hot base of the reactor while complete conversion of the hydrogen sulfide is accomplished in the cooler upper portion of this vessel.

Temperatures have been calculated for the base of the reactor when processing natural gas with varying concentrations of hydrogen sulfide. These temperatures are shown in Table 1. Calculations are based on assumed temperatures of gas in at 80° F., glycol in at 100° F., and gas out at 100° F.

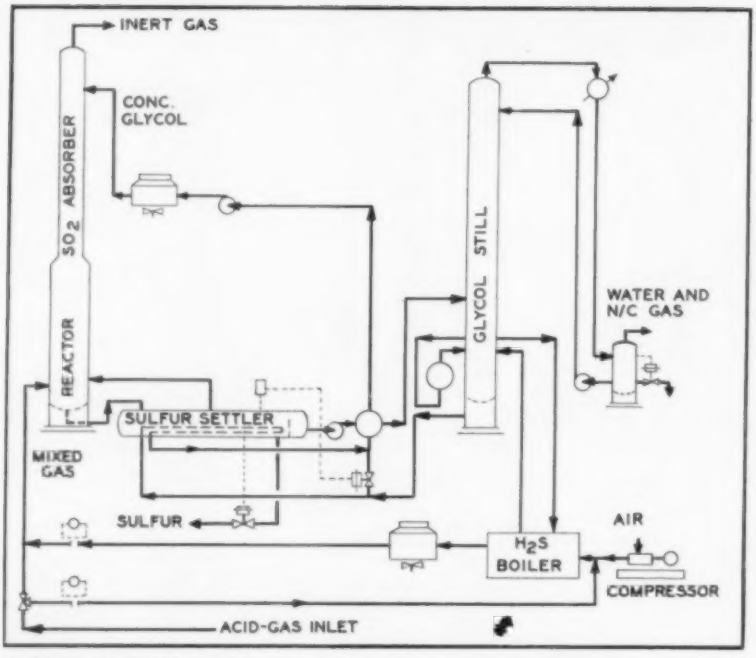
TABLE 1 — TEMPERATURE AT BASE OF REACTOR

H_2S, vol. %	Temp., °F.
1	120
10	200
20	215
40	225

Sulfur recovery . . . Sulfur and glycol slurry is conducted from the base of the reactor to a settling drum where the mixture is heated to 250°-275° F. Excess sulfur dioxide is stripped from solution and returned to the reactor. The sulfur particles melt, stratify, and liquid sulfur is withdrawn from the system. Glycol is decanted, reconcentrated, cooled, and recirculated through the system where one portion recovers excess sulfur dioxide from the residue gas.

The remainder absorbs the sulfur dioxide requirement from the flue gases from a sulfur burner and is pumped into the reactor. Approximately one-third of the sulfur withdrawn from the settling drum is burned and recycled in the process as sulfur dioxide.

Further inspection of Fig. 2 indicates that sulfur dioxide can be lost from but three points: In residue gas discharged from the top of the high pressure absorber, from the sulfur-burner residue gas vented from the



ACID-GAS SERVICE flow diagram for Townsend sulfur-recovery process. Fig. 3.

top of the low-pressure absorber, and from the glycol still overhead. It is obvious that very high recovery efficiency may be obtained from adequate design and good operation.

Processing Amine-Unit Acid Gas

The Townsend process may be employed to recover sulfur from acid gases produced by an amine-type sweetening plant as shown in Fig. 3. Referring to this diagram, the acid-gas stream is split so that one portion, comprising one-third of the total stream, is mixed with air and burned in a boiler to produce the sulfur dioxide requirement for the process.

Heat from the boiler may be used to generate process steam or used to reconcentrate the glycol solution employed in the process. Flue gas from the boiler is cooled to 120°-130° F. prior to mixing with the remaining two-thirds of the acid-gas stream. The commingled gas is then charged to the reactor. It is important to note that it contains the reactants in stoichiometric proportion and that the excess sulfur dioxide required for complete conversion of the hydrogen sulfide is retained in and recycled between the reactor and the absorber; a feature that contributes substantially to improvement of sulfur-recovery efficiency.

The reaction between hydrogen sulfide and sulfur dioxide proceeds in the reactor, as described before. Sulfur is melted and withdrawn from the system and glycol is decanted, reconcentrated and recirculated in precisely the same manner shown in Fig. 2. Freshly reconcentrated glycol exchanges heat with the contents of the settling drum and with the glycol feed to the still. Then it is cooled to near-atmospheric temperature and pumped to the top of the absorber where it takes up excess sulfur dioxide and water vapor as it descends into the reactor.

The basic differences between this version of the Townsend process and that shown in Fig. 2 are quite obvious. Since the sulfur dioxide requirement is provided by oxidizing one-third of the acid-gas stream, the sulfur burner and accessories shown in Fig. 2, including the flue-gas absorber, are eliminated.

Glycol is pumped to the top of the absorber in a single stream for there is no need to split flow in this low-pressure application. Cooling of the sulfur dioxide - bearing gas prior to mixing at the reactor inlet likely will be required in order to maintain temperature control in the base of the reactor. In all other respects, the two versions of the process are identical.

Other variations . . . Other variations of the process are possible. For example, if the carbon dioxide content of the acid gas stream were so high that oxidation is difficult or impossible, then hydrocarbon gas — either sweet or sour—may be mixed with the acid gas supplied to the burner in a quantity sufficient to insure combustion. Others include substitution of flame-free catalytic oxidation for the conventional fired boiler shown in Fig. 3 as the means for supplying sulfur dioxide to the process, or use of liquid sulfur dioxide in a group of small lease-type installations designed to remove trace quantities of hydrogen sulfide from sales gas and other gas.

There is some reason to believe that a version of the Townsend process, similar to that shown in Fig. 3, might be applied to some contemporary sulfur recovery plants to economic advantage. Located on the vent-gas line, it would function effectively as a scrubber and condenser for sulfur dust and vapor; it would convert unreacted hydrogen sulfide by reaction with sulfur dioxide which, if present in excess, may be recovered and returned to the Claus unit.

In effect, such an installation would add another highly efficient stage. Economic justification would depend on the design, capacity and efficiency of the existing plant.

Limitations . . . Insensitivity of the Townsend process to carbon dioxide will impose a limitation on its use for direct gas processing for sale when the carbon dioxide content exceeds pipeline specification. The most economical solution to this problem appears to be treatment of the sour gas with amine water to remove the hydrogen sulfide and to reduce the carbon dioxide content to specification. The treated gas is dehydrated before passing to the sales meter, while the Townsend process could be employed to convert the hydrogen sulfide from the amine unit to elemental sulfur.

A second approach involves use of the Townsend process to remove hydrogen sulfide and recover it as sulfur, the amine-water process to reduce the carbon dioxide to specification and, finally, a dehydration unit to meet water-vapor-content requirements. Since this alternative involves three separate high-pressure processing systems and automatically creates water makeup problems in the amine treater, it is much less attractive than the first.

Fluctuations in hydrogen sulfide or sulfur dioxide concentrations or in gas-flow rates do not pose serious problems in the Townsend process if the glycol circulation rates are adequate. As in any continuous process, quality of the operation is enhanced by steady flow rates and uniform concentration of the reactants, but some fluctuation can be tolerated to a point.

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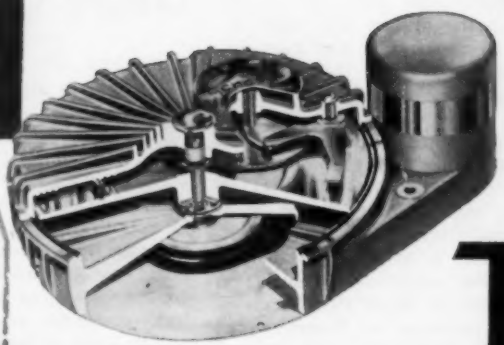

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Beyond this, the system will require additional instruments and controls to insure satisfactory operation.

Corrosion . . . In view of the insensitivity of the process to carbon dioxide, evidence available to date indicates the probability that stress-reliever carbon-steel components may receive effective protection from filming-type corrosion inhibitors carried in the organic solvent. Where sulfur dioxide is absorbed from burner gas, excess oxygen contained in this mixture may require that the flue-gas absorber be of alloy construction, or alloy-lined, or treated with an effective protective coating.

However, this is a low-pressure vessel and not excessively costly. Corrosion studies are under way at present to determine the extent of corrosive attack by the reactants on mild steel in the presence of highly concentrated glycols and to observe the degree of protection afforded by various inhibitors, buffers, and epoxy-resin coatings.

Process Economics

In processing high-pressure sour gas for pipeline sale, the economic aspects of this process appear promising for several reasons. It involves but one process instead of two or possibly three contemporary processes employed in series to accomplish gas sweetening, residue-gas dehydration, and recovery of elemental sulfur. Gas shrinkage in the Townsend process is substantially less because of its insensitivity to carbon dioxide. Residue-gas dehydration is inherent in the process and sulfur-recovery efficiency is at least equal to, or substantially better than that obtained with the two-stage Claus process.

Power consumption is less than that required by the aggregation of processes cited above and it should be operated with the same labor required for a conventional amine-water sweetening plant. A substantial reduction in purchased power would result from development of larger P-V pumps of the type produced by Kimray, Inc., recognizing that such a development would enhance the economics of the amine-water process also.

Effect of concentration . . . Recovery of sulfur by means of the Townsend process depends on the hydrogen sulfide content of the gas and the efficiency incorporated into the design of the process itself. If the gas contains but a few grains of hydrogen sulfide per 100 cu. ft., sulfur must be supplied from an extraneous source to provide the sulfur dioxide requirement or liquid sulfur dioxide might be provided in cylinders. However, as hydrogen sulfide concentration increases, process requirements for sulfur will be met and surplus sulfur will be available for market.

"In processing high-pressure sour gas for pipeline sale, the economic aspects of this process appear promising for several reasons. It involves but one process instead of two or possibly three contemporary processes employed in series . . ."

It is anticipated that earlier industrial applications of the process will be directed to very sour gases where sulfur recovery is the principal objective. Ultimately, sweetening of slightly sour gas may become attractive, since this reaction appears to be even more sensitive than the amine-water process in removal of trace amounts of hydrogen sulfide.

Comparative economic studies on relatively large plants indicate that the unit cost of treating gas by the Townsend process and the amine-water process are approximately identical, when the carbon dioxide content of the gas is 1.0%, without considering the value of the sulfur recovered by the former. As the carbon dioxide concentration increases, the unit cost is substantially higher in the amine-water process.

As the hydrogen sulfide concentration increases, the operating credit from sale of sulfur reduces this charge. Based on current costs of equipment and labor and the price of sulfur, these studies indicate that sulfur revenue will offset operating charges when the hydrogen sulfide content ranges from 2 to 3%.

To date, no detailed studies have been made which compare costs of the Claus process to that of the Townsend process when used to recover sulfur from the acid-gas streams from treating plants. Cursory studies indicate that lower investments and greater efficiency are found in the Townsend process. Operating costs vary considerably with the design of various versions of the Claus process, but the Townsend process should compare quite favorably without taking credit for improved handling of high carbon dioxide and heavy hydrocarbon vapors often found in these acid-gas mixtures.

References

1. U. S. and foreign patents pending. Licensed to Hudson Engineering Corp., Houston.
2. Gamson, B. W., and Elkins, R. H.: Chem. Eng. Prog. (1953) 49, 4, 203.

Gage glass detects small leaks

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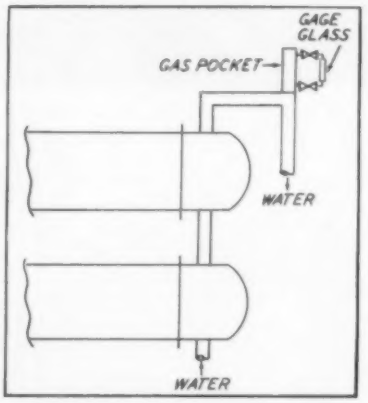
Normally, small leaks are quite difficult to detect. If the leak occurs on an upstream condenser in a bank of condensers, the gas can destroy inhibitors in the water being charged to the downstream condensers. This will result in aggravated corrosive and fouling conditions not limited to the leaky condenser alone.

The water outlet line from the condenser, or each bank of condensers, is equipped with a short riser to form a high leg. An instrument gage glass is mounted across this riser. If a leak occurs, gas will accumulate in a pocket in this riser and also be seen in the gage glass. The indication will be rapid and sufficient to warn the operator that corrective steps should be taken.

This device also makes it practical to pinpoint the leaks quite readily. Many times a condenser has been pulled offstream for inspection only to find that it was not the faulty item. The gas-pocket gage glass detector will eliminate this trial-and-error approach.



Method suggested by Kirby H. Carroll, operator, Baytown, Tex.; courtesy Humble Oil & Refining Co.

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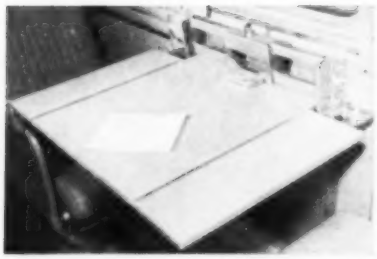

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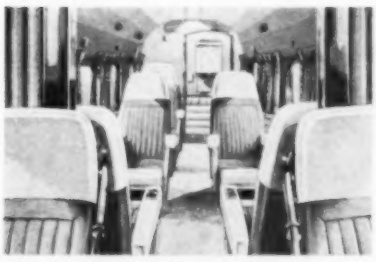

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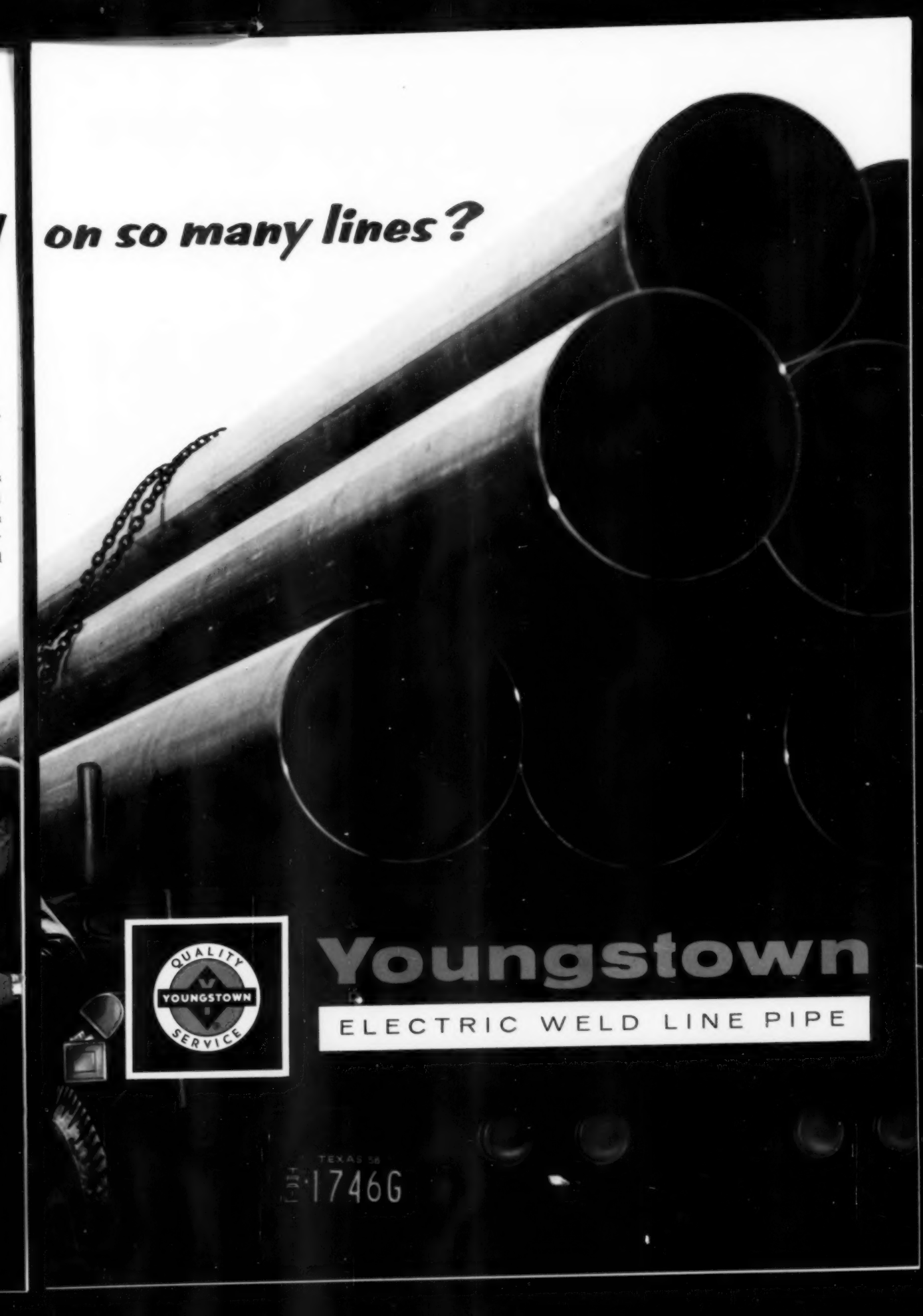
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BY PAUL REED
Pipeline Editor

PROFILE of Oleoducto del Pacifico products line from the seaport of Buenaventura to the inland terminal at Cali, Colombia, is shown at the bottom of the page. Immediately below are the Buenaventura station, at left, and the Yumbo terminal, near Cali, at right. At Buenaventura, pumps and engines are behind hay tanks, filters, and calibrating tanks. Throttle valve in right foreground of the Yumbo terminal maintains 450-psi. back pressure. Perry Dillon, assistant operating superintendent, and Max B. Ederington, are in left foreground.

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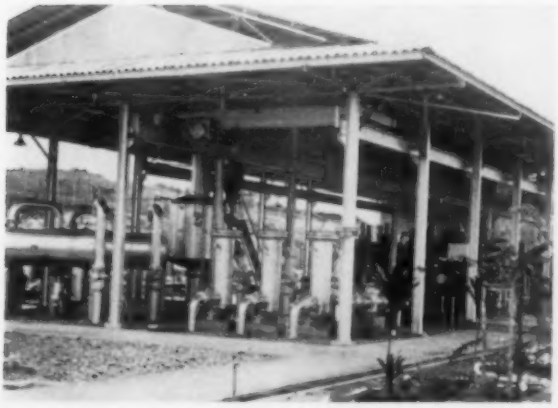
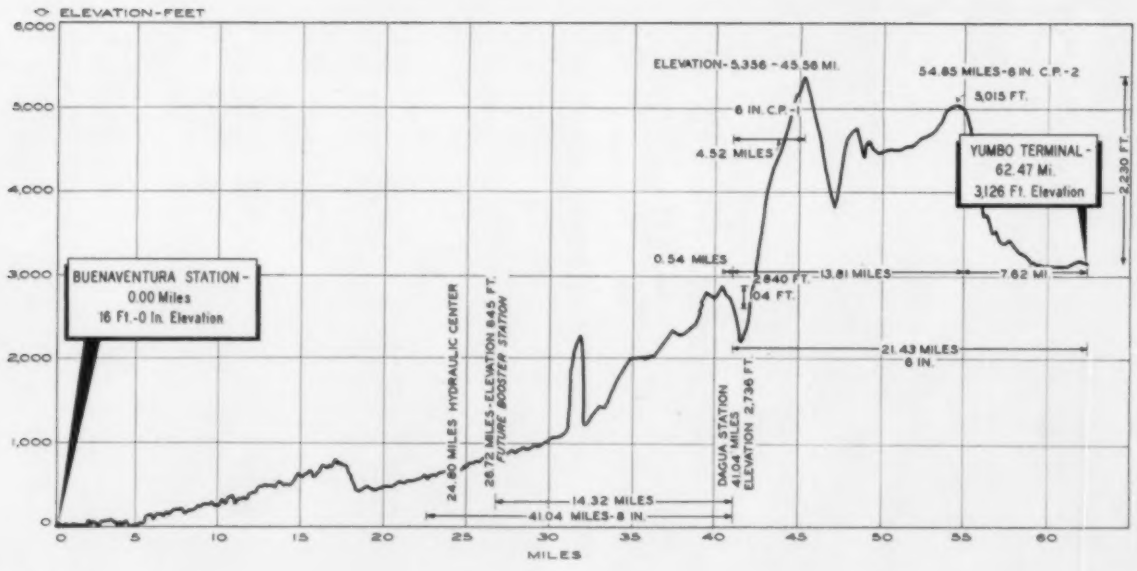
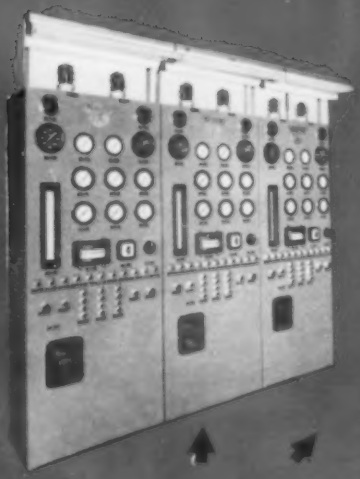
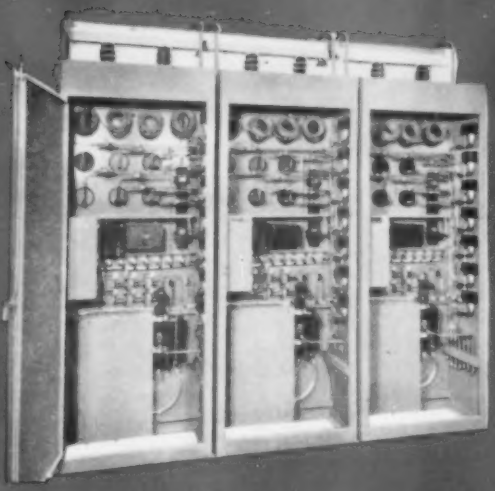
Yumbo—62.47 miles









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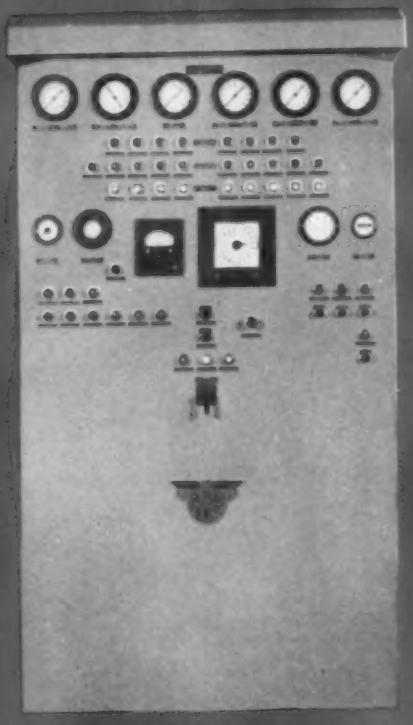

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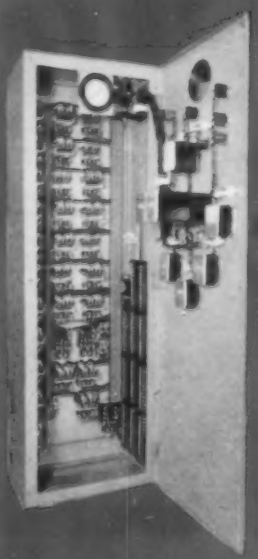

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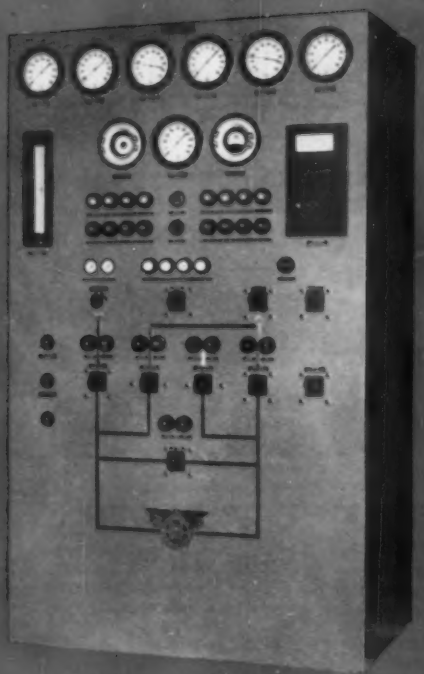

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flow rates and high static heads was solved by using a combination of two types of plunger pumps. This combination consists of two triplex variable-stroke pumps operating in parallel with a quintuplex fixed-stroke pump. Each of the two pump stations—Buenaventura and Dagua—is equipped with such pumps. Two years of recent initial operation have demonstrated the flexibility of these units.

Current throughput demand and prospects for future growth justify the economic feasibility of these pumps.

By using variable-stroke pumps in combination with a fixed-stroke pump the discharge pressure can be held constant over a wide range of flow conditions. This combination enables the line to operate at the desired pumping rate at constant engine speeds. Throttling valve losses are avoided because the power consumed by the variable-stroke pumps is very nearly proportional to the rate of output.

Variable-stroke pumps have been useful for products pipelines where high heads, a wide variation in viscosity, and a wide range of flow rates make it difficult to use centrifugal pumps without large throttling losses.

Length of the stroke is changed by tilting the crosshead (acting on an angle with both the plunger and the crankshaft). Thus the relationship of throw to reciprocating motion is changed so as to lengthen or shorten the stroke of the pump.

Since both the triplex variable-stroke and the quintuplex fixed-stroke pump are high-speed plunger pumps, with built-in, low-ratio gears, they can be directly connected to medium-speed engines. The combination of variable engine speed and variable plunger stroke can be used to meet the wide range of pumping conditions.

Alternative Pumps

While the reciprocating pump is more practical for small volume and the centrifugal pump is more practical for large volumes, the combination of variable-stroke and fixed-stroke is more satisfactory, though more expensive in first cost, for handling a range of small to large volume throughput against high pressure. It would be 10 to 15 years before Oleoducto's volume would be large enough to justify centrifugal main-line pumps.

In the preparation of this article, the author has been assisted by Max B. Ederington, manager of Oleoducto del Pacifico, Cali, Colombia; Floyd E. Warterfield, Jr., president, Pipe Line Engineering Co., Dallas, consultant and designer of the system; I. R. Cunningham, vice president, and Clyde Johnson, transportation coordinator, International Petroleum Co., Coral Gables, Fla.

Survey

When Max B. Ederington took the author over the line by plane, railroad motor scooter, and automobile, it was hard to believe the route had been located and surveyed in 3 months. Refinement relocations were subsequently made but the hydraulic design was based upon the original survey. After seeing what had been done, it would be difficult to predict a place where a pipeline could not be built.

Cliffs were too steep and the river was too rough and rapid for a pipeline in some sections of Dagua River

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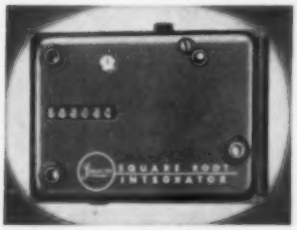

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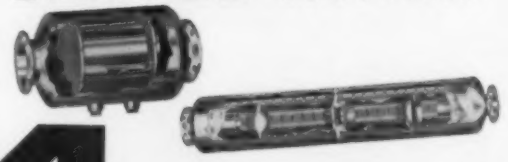

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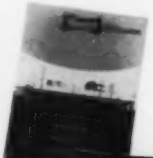

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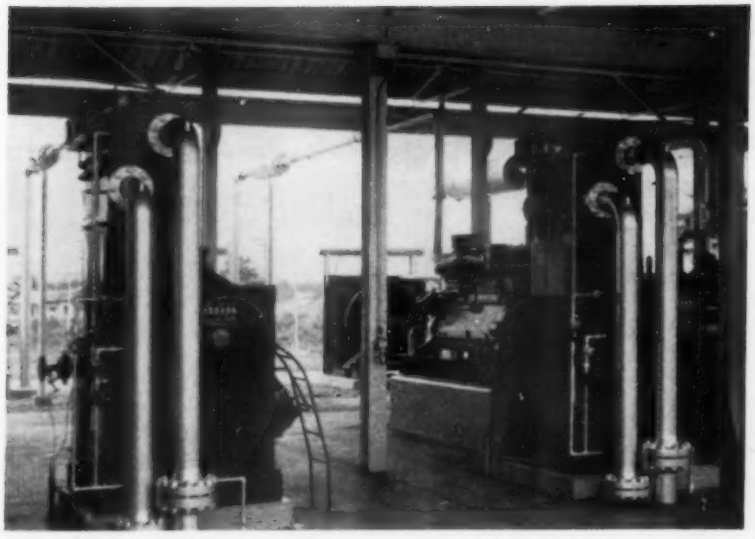

TWO VARIABLE-STROKE triplex plunger pumps with controllable capacity at the Buenaventura station.

Canyon. So the line had to follow an abandoned, centuries-old mule trail high up on the mountainside. The Spaniards could not foresee that they were building a right-of-way for a future pipeline, but without it the project would not have been economically feasible. The ancient trail is not continuous. On some slopes, too steep for mules, pipe was carried up by hand. The side of Mount Pinal above Dagua station is so steep that a 1,500-ft. section of pipe had to be slid down from above.

In a valley where the line could run along near the river, there were 15 river crossings in 4 miles of one section.

Landslides are frequent. But so far they have not done serious damage. A slide near Delfina lifted up the pipeline and threw it out on the road for 15 ft. with a sharp bend.

Details of construction have been discussed in earlier articles on Oleoducto del Pacifico (The Oil and Gas Journal, April 9, 1956, p. 84; Petroleo Interamericano, May 1956, p. 89).

Design of Line

For location of the pipeline from the seacoast terminal at Buenaventura (elevation 16 ft.) to the Yumbo terminal on the outskirts of Cali (elevation 3,142 ft.), a route was selected for 41.11 miles of 6-in. from Dagua station to the Yumbo terminal.

The control point downstream from Buenaventura station for the 8-in. section is at elevation 2,860 ft., ½ mile upstream from and 123 ft. above the Dagua station.

Static head at the Buenaventura station for the products handled is:

	Final estimate (lb.)	As operated (lb.)
Diesel fuel	1,022	1,064
Kerosine	983	1,004
Regular gasoline	887	922

Static pressures at the Yumbo terminal and the Dagua station are indicated as follows:

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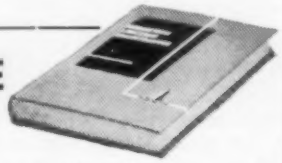

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Yumbo terminal:	Feet
Elevation at milepost 45.56	5,358
Elevation at Yumbo terminal	3,142
Maximum static head at Yumbo	2,216

	Final estimate (lb.)
Maximum static pressure at Yumbo	
Diesel fuel	825
Kerosine	778
Regular gasoline	712

Dagua station:	Feet
Elevation 6-in. line control point at milepost 54.27	5,171
Elevation at Dagua station milepost 41.11	2,737
	2,434

	Final estimate (lb.)	As operated (lb.)
Static pressure at Dagua station:		
Diesel fuel	825	906
Kerosine	793	855
Regular gasoline	716	784

Final design computations showed that completed facilities have a maximum line capacity of 29,160 bbl. per day which is 2% above preliminary theoretical calculations.

Pipe was hydraulically tested in sections with water at 2,000 psi. for several hours, demonstrating that it withstood the design limit of 1,500 psi.

Pumping Capacities

The initial existing pumps—three at Buenaventura and three at Dagua—have a capacity (two triplex and one quintuplex) of 18,800 bbl. of regular gasoline per day (96% volumetric efficiency) at engine speed of 925 r.p.m.

Later on the full initial 29,160 bbl. per day capacity of the present pipeline (with gasoline) could be realized by installing a second quintuplex fixed-stroke pump at each of the two stations and by operating both quintuplex pumps at 219 r.p.m. while one of the two triplex variable-stroke pumps would be operated for capacity control.

Expansion

Still later a maximum capacity of 55,000 bbl. per day at 85° F. with regular gasoline could be achieved by: (1) looping the 6-in. section; (2) building a five-unit booster station on the 8-in. line; (3) adding a fifth unit at both Buenaventura and Dagua stations.

Present Operations

Actual throughputs in the past 2 years have been about 5,700 to 6,000 bbl. per day. When the author visited the line, shipments, not including aviation gasoline, were coming from the Cartagena refinery, owned by an affiliate of International Petroleum Co., in a T-2 tanker (gasoline capacity 135,000 bbl.), arriving at Buenaventura every 20 days or so. On the day of the visit, the Buenaventura station was pumping motor gasoline at 1,150-psi. discharge pressure at the rate of 750 bbl. per hour.

While product separation can be maintained at pumping rates of 100 bbl. per hour, the minimum rate for established operating procedure is 165 bbl. per hour—3,960 bbl. per day.

The main pumps (two variable-stroke and one fixed-stroke at each station) and their engines are as follows:

Variable-Stroke Pump Unit

Pump—Aldrich-Groff controllable capacity triplex-plunger pump:

Bore and stroke: 0-6 by 2⅞ in.

Pump r.p.m.: 222.

Driver r.p.m.: 925.

Maximum rated pumping capacity at 100% efficiency: 3,864 bbl. per day.

Maximum discharge pressure: 1,500 psi.

Minimum suction pressure: 15 psi.

Engine—Caterpillar D-342, six-cylinder:

Bore and stroke: 5¾ by 8-in.

Governed operating speed: 925 r.p.m.

Brake horsepower — continuous duty: 136 hp. at 925 r.p.m.

Fixed-Stroke Pump Unit

Pump—Aldrich vertical quintuplex:

Bore and stroke: 4⅛ by 6-in.

Pump r.p.m.: 203.

Driver r.p.m.: 925.

Maximum rated pumping capacity at 100% efficiency: 503 bbl. per hour, 12,072 bbl. per day.

Maximum discharge pressure: 1,500 psi.

Minimum suction pressure: 5 psi.

Engine—Caterpillar D-397:

Bore and stroke: 5¾ by 8-in.

Governed operating speed: 925 r.p.m.

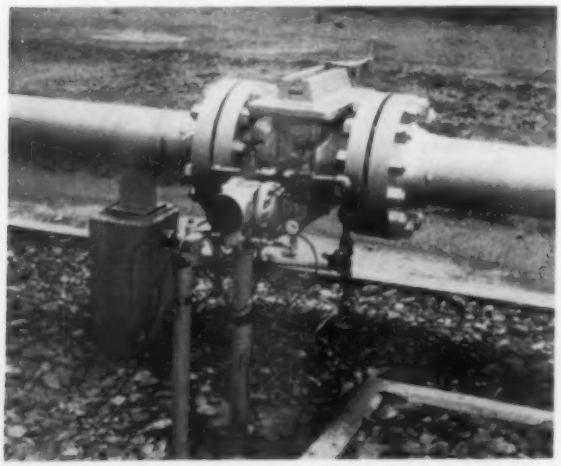
Idle speed: 425 r.p.m.

Brake horsepower — continuous duty: 374 hp. at 925 r.p.m.

The instrumentation and system operating controls were planned and designed by H. Yellin, chief engineer for Pipe Line Engineering Co. Due to the isolated locations of the stations, the greatest amount of functional control had to be built into the system and at the same time utilize the least amount of easily maintained equipment.

Controls mounted at each engine act to push the fuel pump rack to the closed position for safety shutdown in case of low lubricating-oil pressure or high jacket-water temperature. Condition initiating the shutdown is indicated by signal on the panel.

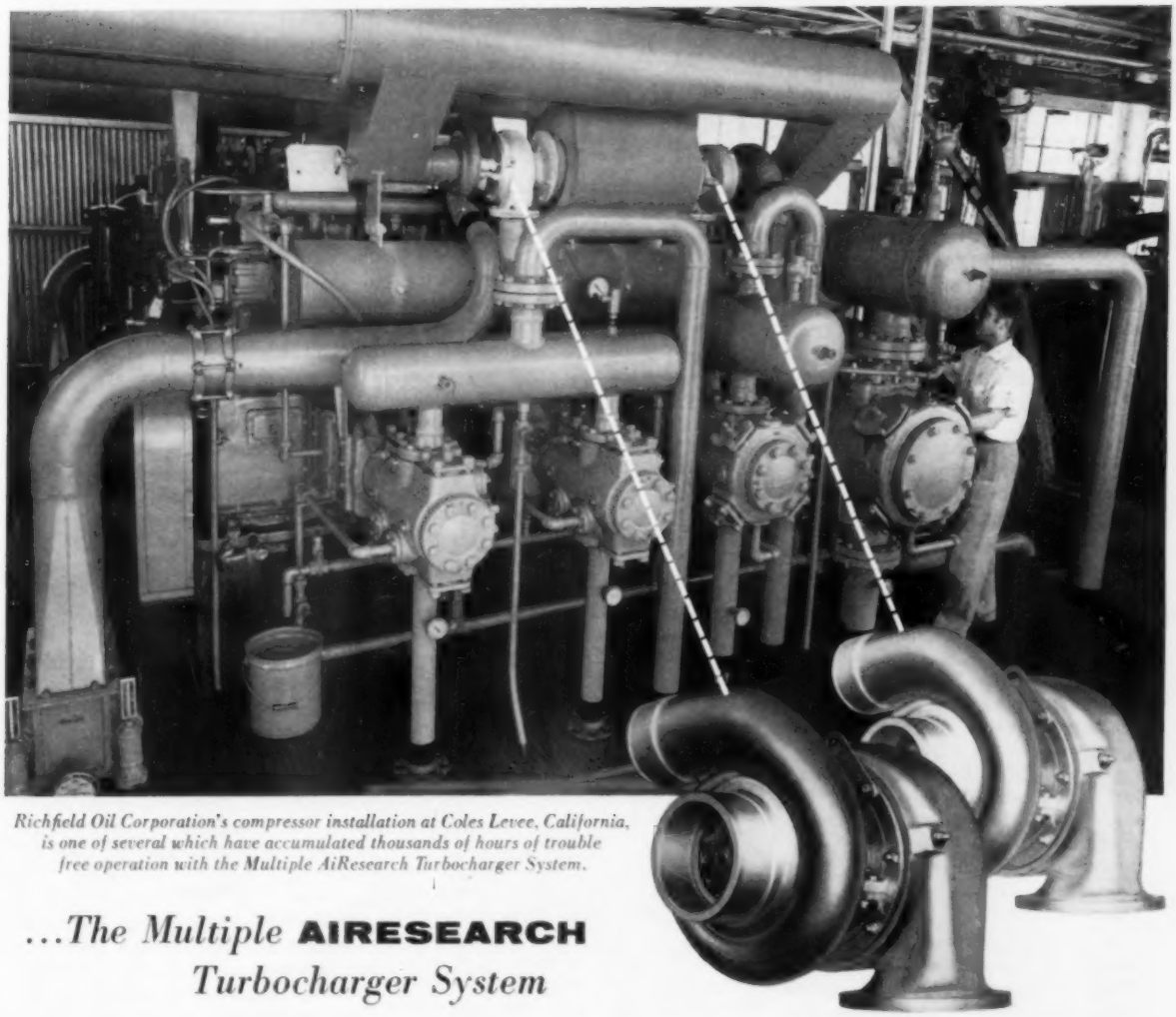
At the control board of each sta-



FLOW METER at Buenaventura station, from which flow data are transmitted by telemeter to the Cali office.

SEATED on the company's own motor scooter are Max B. Ederington and Paul Reed, the Journal's pipeline editor.

POWER BOOSTING RICHFIELD'S 2-CYCLE GAS COMPRESSORS



Richfield Oil Corporation's compressor installation at Coles Levee, California, is one of several which have accumulated thousands of hours of trouble free operation with the Multiple AiResearch Turbocharger System.

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has helped solve the Richfield Oil Corporation's need for more power to meet increased demands at its compressor stations. Turbocharging the 2-cycle natural gas engines with the Multiple AiResearch Turbocharger System proved to be an economical and quick method for boosting power.

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tion, instruments indicate and record: (1) rate of flow in pipeline system; (2) suction and discharge pressures—automatically controlled; (3) specific gravity of products pumped; (4) temperature of product pumped. Also, the indicator and alarm notify of shutdown of pump station in the event of abnormal operation.

Flow of products from pumps into the line is controlled as a function of the pressure controller—the primary control for the station which automatically positions the variable pump stroke and the fixed - stroke pump bypass.

Pressure control . . . The pressure controller positions both the variable-stroke control and fixed-stroke pump's bypass control valve for maintaining required main-line discharge pressure with automatic transfer to prevent station suction pressure from falling below the suction pressure discharge set point.

The variable stroke length and the related capacity of the variable-stroke pump is controlled by means of an air diaphragm motor with a range from 5 to 25 psi. At 25-psi. air output from the pressure controller, the pump will be at full stroke delivering its maximum capacity. At 5 psi. or less, the pump is at zero stroke and zero capacity.

Control of the fixed-stroke pump throughput into the system and the discharge pressure is accomplished through bypassing part of the pump discharge back to the suction through the bypass control valve operating over a 3 to 15 psi. range. Here is an example of how this control system works when discharge pressure rises due to a slowdown in delivery at the Yumbo terminal:

It is assumed, in this case, that pumping is being done with the fixed-stroke pump and one variable-stroke pump. Decreased pressure controller output (4 psi. for example) will reduce pump-stroke length to zero at the variable-stroke pump, and it will partly open the bypass at the fixed-stroke pump until the discharge pressure returns to the pressure controller set point.

Overriding controls . . . The No. 1 station at Buenaventura on the seacoast will normally operate on discharge pressure control with suction pressure override.

The No. 2 station at Dagua in the mountains normally operates on suction pressure control with discharge pressure override.

The flowmeter may be used for setting the pressure controller discharge set point to maintain the required rate of flow at Buenaventura station.

If flow rate increases above normal due to a leak or break in the main line, the excess flow switch will make contact to close its circuit to the safety - shutdown - signal control panel in order to: (1) actuate excess flow and indicating lamp; (2) sound an audible alarm, and (3) shutdown all main pumping units, thus taking the pump station out of operation.

Telemetering

For transmitting rate of flow information to the dispatcher's office at Cali, the following equipment is involved:

1. The Teletax telemeter transmitter is of the impulse duration type and consists of a cam (rotating at 5 r.p.m.) and a cam follower. Duration of the transmitter impulse corresponds to the closed period of the mercury switch. This signal is sent by a microwave channel to the Cali dispatching office where it is recorded on a flow recorder. The company's microwave system is the only one in Colombia.

2. Flow transmitter (differential-pressure transmitter of aneroid type without mercury)—range 0-100-in. of water; scale 0-125 sq. root.

3. Flow is measured by differential across orifice plate at meter. Bore 4.605 in.

The recording gravitometer (product sampling type) allows complete change of product through the instrument every 40-45 seconds with rate of flow 1,500 cc. per minute.

Thermometer records temperatures from 50° to 150° F.

The inhibitor injection system at the Buenaventura station injects an oil-based soluble rust inhibitor (Santoline C).

The dye plug injector at Buenaventura injects an oil-soluble powdered dye mixed in a 1-gal. container. This dye is injected at the interface between products so that the arrival of the interface may be readily determined when it enters the downstream station at Dagua and the Yumbo terminal.

Auxiliary equipment also includes two 100-hp. diesel electric units for various station needs such as motors for suction pumps, fans, etc.

Pumping From Tanks to Station

Some features of equipment between storage tanks and main-line pumps may be mentioned:

The suction mercoid switch at the station booster pump will automatically trip the booster pump off, in case of failure, in opening the tank gates or manifold valves in accordance with operating procedures. Also, it will trip the pump in case of loss of suction head due to low tank levels. The two eight - stage vertical long-barrel suction pumps operate alternately to equalize wear.

Hay tanks (water separators packed with excelsior) and strainers insure that only clean filtered products enter the positive-displacement meters. The meters are equipped with dual countershifters, each fitted with counter-printer combination to facilitate imprinting of delivery tickets showing meter reading at the beginning and end of each run. Computations for volume corrections (average temperature and meter correction factor) are made on the face of the ticket for the original and carbon copies. Meters are calibrated for each product pumped because meter factors will vary with different products due to difference in fluid friction.

All shipments into and out of the line are metered.

An interesting feature of the system is provision for controlling pressure at the Yumbo terminal. Because of the static pressures of 700 lb. and more at Yumbo, a 450-lb. pressure must be held on the line to keep it full at the control point while products are delivered.

Since the beginning of operations, back pressure has been maintained by an automatic throttle control valve.

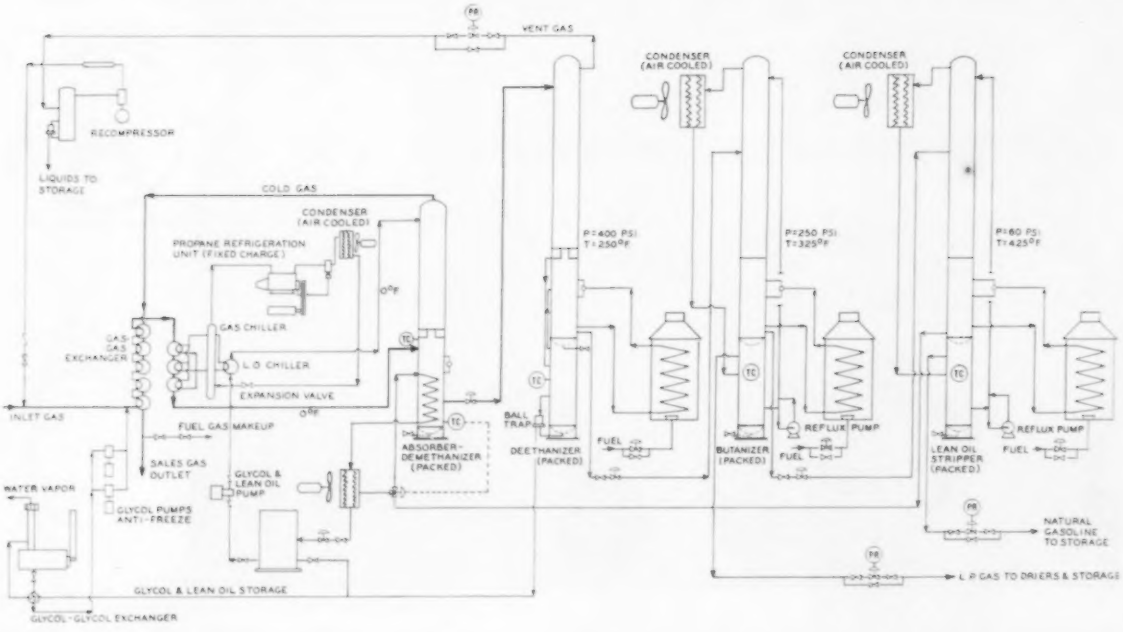
This valve is supplemented by an electric-motor-operated plug valve controlled by radio from the Dagua station upstream. This serves as an emergency valve, shutting off when pumps stop operating at Dagua.

Shippers

For more than a year of initial operation, the only shipper was Esso Colombiana, S.A., but in October 1957 Colombianos Distribuidores de Combustibles, S.A. (Codi), began shipments. In the future it is expected that Shell will also enter this area. However, it does not appear that volume will increase soon, as a consequence, for the existing market will be divided among all shippers. Shippers furnish their own tanks at the terminals.

Pipeline tariffs, approved by the Colombian Government, have been established at 6.5 centavos (about 0.85 cent U. S.) per gallon.

Six grades of products are segregated for shipment by Esso Colombiana: two of aviation gasoline (91-98 octane for smaller planes and 100-130 octane for larger planes); two grades of motor gasoline; one of kerosine, and one of diesel fuel.



Practical designing such as this flow diagram for a refrigeration-extraction and fractionation plant have helped put . . .

"Miniature plants" on the upswing

THE SMALL-SCALE field processing plant is coming into its own in a big way. The economic picture has brightened in the past few years to make the "mini plant" practical.

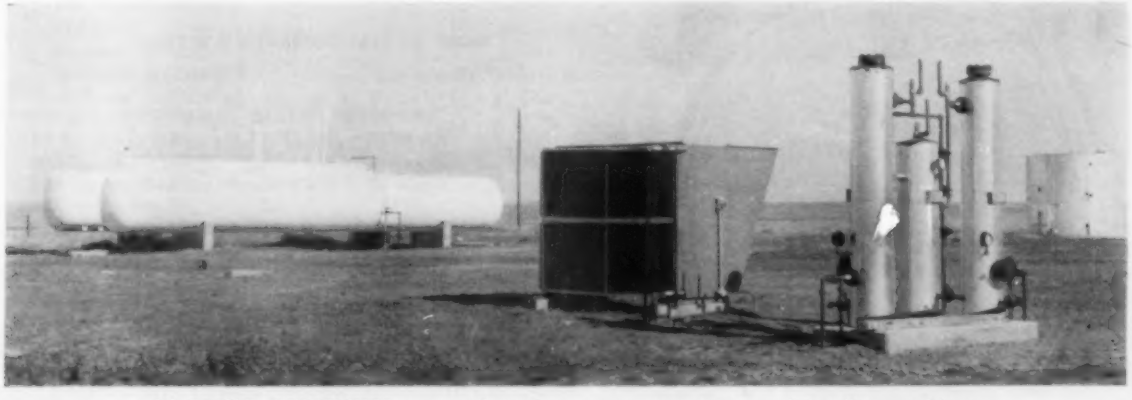
The swing to these Tom Thumb-sized installations has been quite marked with 63 plants currently processing 5 million cubic feet or less of gas per day. This comprises 13% of the gasoline and cycling plants in operation in the United States.

Advantage of these small plants is their ability to extract marketable liquids from small, marginal fields, which are not capable of supporting a large, conventional extraction plant.

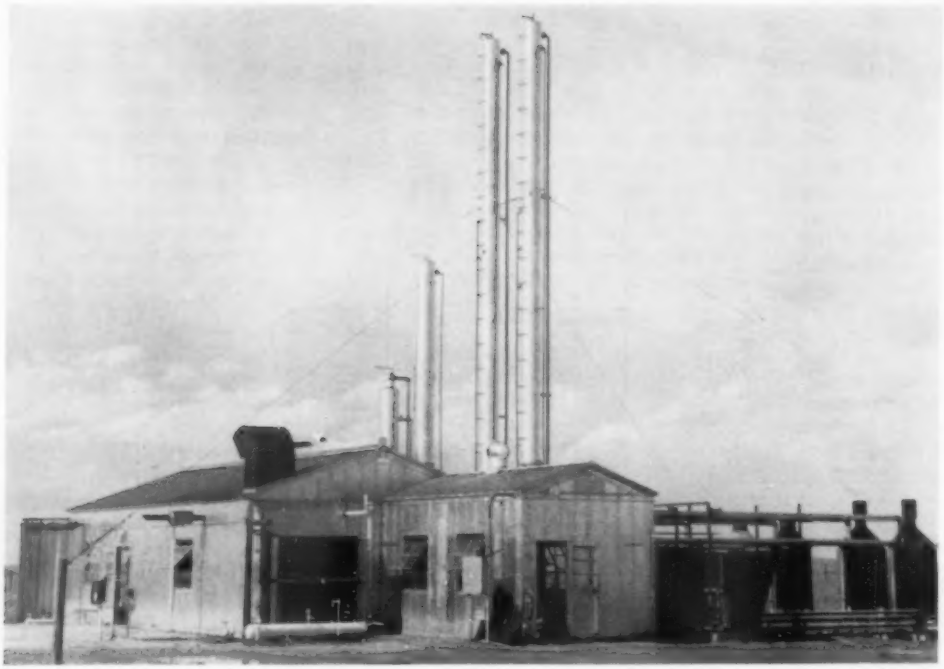
Design, of necessity, eliminates frills and concentrates on cost-cutting features. Examples of how efficient, money-making plants can be constructed may be seen in several built by Russell Engineering Corp., Houston.

BY GEORGE F. RUSSELL, Russell Engineering Corp., and **LARRY RESEN,** District Editor

Design of all of these plants emanated from a basic plan to which minor modifications were made to fit individual conditions. Fig. 1 shows the flowchart for one of these basic plants. Actually, this particular base layout includes two plants—a refrigeration-extraction section on the left, and a fractionation section on the



AIR-COOLED CONDENSERS are used to eliminate water-treating and handling problems.



COMPACTNESS of plant is a valuable asset.

Vest-pocket field-processing plants are overcoming technological and economic hurdles to provide producers with production-plus income.

right. This multipart aspect of the plant is one of its key features, whereby it can grow to meet expanding needs. In the initial phase of a field's development, the refrigeration-extraction plant alone can be installed. With this arrangement, a single stabilized liquid product is extracted from the gas stream.

In subsequent phases, the fractionating section can be added to split up the liquid products. And the fractionation train can be expanded as desired. It can begin as a propane-and-natural-gasoline, two-liquid system and then by simple addition of a tower become a three-product plant by debutanizing the gasoline and providing a butane product.

In cases where a field develops rapidly to require more than one extraction plant, it may be practical to include a common lean-oil absorption system and common fractionating equipment. Meanwhile, the refrigeration-extraction sections can be added in multiples. Likewise, these refrigeration-extraction plants can be pulled offstream individually with declining field production and have a high salvage value for other field installations. In all cases, however, the basic flow plan is utilized with minor changes, such as substituting ammonia for propane or freon refrigeration if desired.

In tracing through this particular flow scheme, several short-cut methods may be seen which contribute to an economically attractive picture in the use of miniature plants. Initially, the towers are all constructed with internal accumulators. In these small plants, the over-all tower sizes are small, hence inclusion of the accumulators does not contribute to an unwieldly vessel. At the same time, this design eliminates a lot of external piping and foundations in the plant.

This particular plant is in Colorado, and water scarcity plus water-treating problems contributed to the decision to use air-cooled condensers. By using these compact fan units and

TABLE 1—INLET-GAS ANALYSIS TABULATION

Component	Per cent	Cu. ft. per gal.*	Gal. per M.c.f.
CO_2	.90		
C_1+N_2	74.60		
C_2	10.69		
C_3	9.33	35.78	2.608
iC_4	1.24	29.70	.418
nC_4	2.23	30.77	.725
iC_5	.34	27.398	.124
nC_5	.27	27.68	.098
C_6	.27	24.381	.111
C_6+	.13	23	.056
	100.00		4.140

*Physical Constants and Paraffin Hydrocarbons NGAA Publication 2145-57—CNGA—TS401.

TABLE 2—PLANT-OPERATING RECORD

Month	Operating days	Month's gal./M.c.f.	Monthly production, gal.	Avg. daily throughput, M.c.f.
June—1957	30	2.076	55,150	886
July	31	2.063	56,100	876
August	31	2.123	50,400	766
September	30	2.187	58,300	888
October	31	2.319	58,000	807
November*	*29	*3.669	*82,425	*775
December	31	3.551	91,291	829
January—1958	31	3.558	94,471	857
February	28	3.885	91,210	838

*Absorption-refrigeration facilities installed this month.

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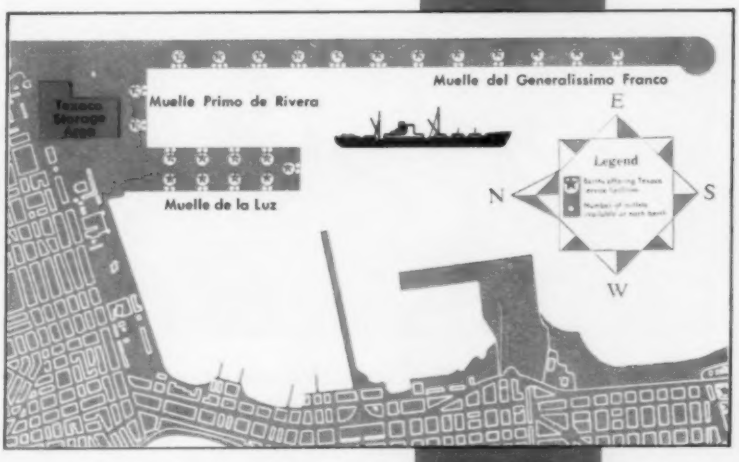

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GREATER ACCURACY . . . positive displacement meters provide accurate register of amount of Bunker C and Diesel Fuel delivered . . . on the spot . . . *faster!*

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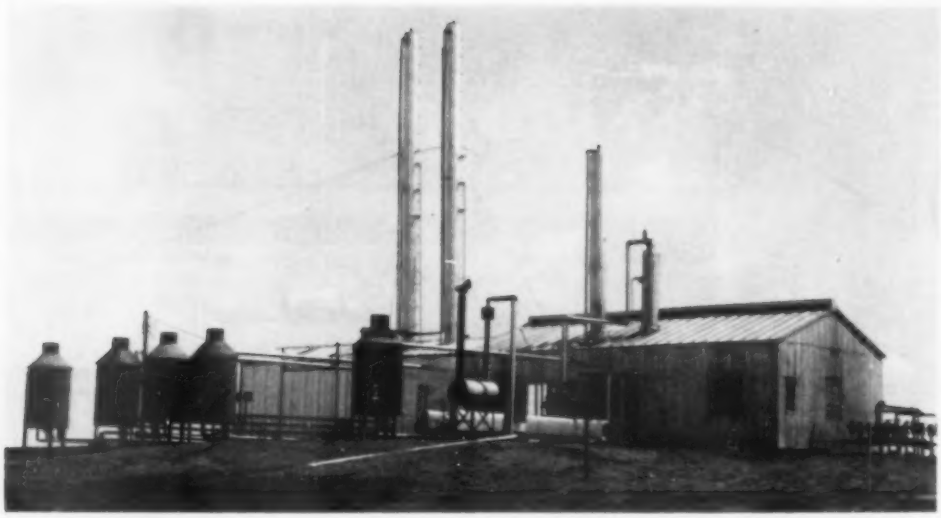


LEADER PLANT in Adams County, Colorado, where secondary addition of absorption and fractionation facilities had a pronounced effect on liquid recovery.

"This particular plant is in Colorado, and water scarcity plus water-treating problems contributed to the decision to use air-cooled condensers."

eliminating water there is no need for water-treating facilities, nor is there any problem with freezups in the frigid winters encountered in the area.

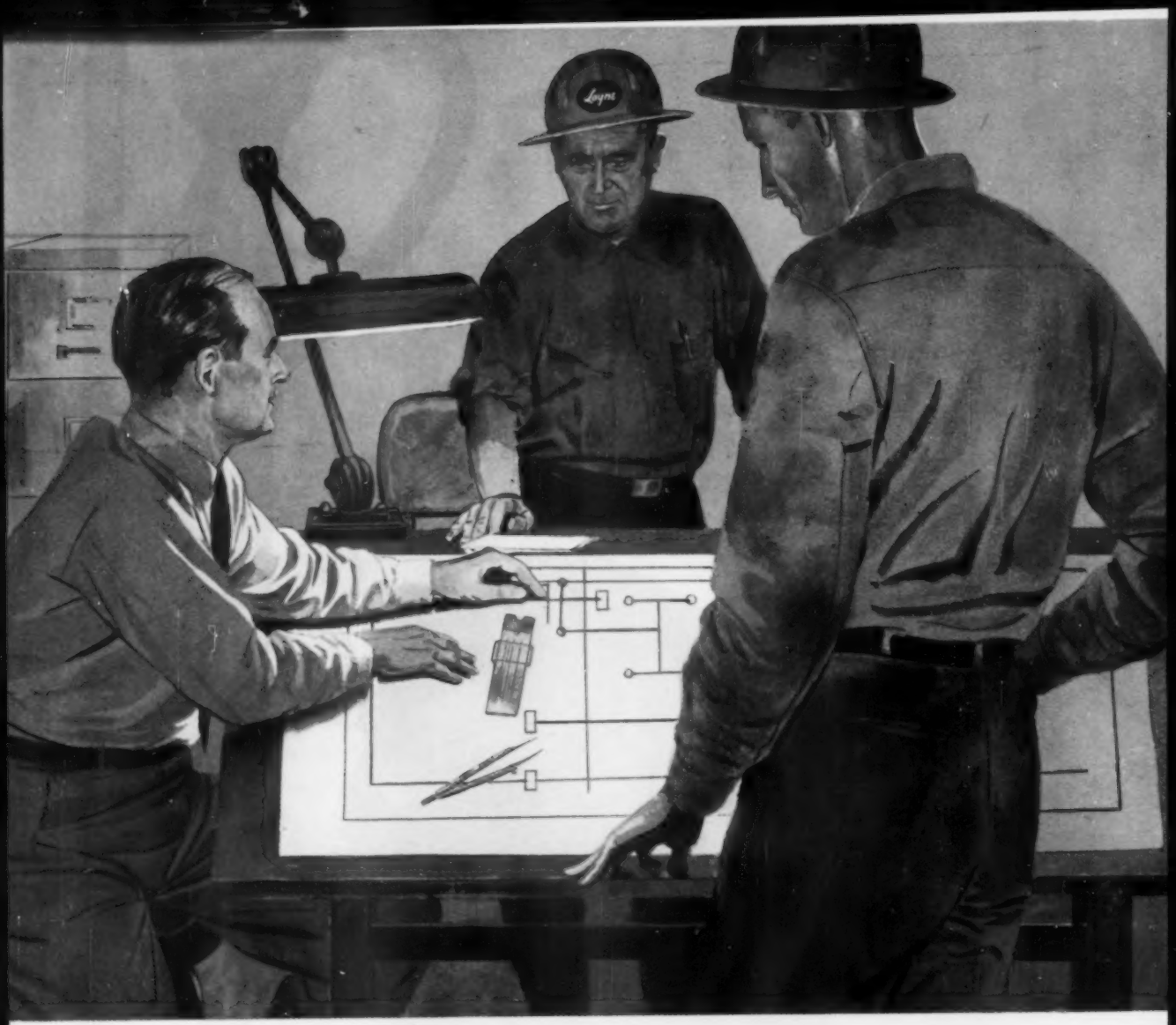
Another significant feature has been the use of direct-fired, thermosiphon reboilers. Several advantages are gained by use of these heaters. Initially, hot-oil circulating pumps are eliminated by taking advantage of the natural thermosiphon effect. Construction of the heaters themselves is inexpensive. These Russco heaters, internally insulated, use helical coils which can be inexpensively fabricated and which in themselves eliminate costly U-bend construction. The reboilers, although gas-fired, are located close to the process area, eliminating long pipe runs. This feature, while a bit unusual for gas plants, is borrowed from general refinery-layout practices where furnaces and heaters are within battery limits in most cases. Finally, the heaters are designed without any convection section, which while adding somewhat to heat benefits would have increased costs considerably.

Accumulation of these features tends to make the mini plants economically attractive. Their efficiency at low gas rates, meanwhile, enhances the picture. A good example of this is the data available on a plant whose throughput actually has averaged less than a million cubic feet of gas per day. With refrigeration, absorption and fractionation facilities available, this plant has extracted an average 3.832 gal. per thousand cubic feet of input gas which has a total 4.14 gal. per M.c.f. liquid contents. This amounts to a gross recovery of 92.5% on total liquids. Analysis of inlet gas at this particular plant owned by Ginther, Warren & Ginther, et al., in Leader field, Adams County, Colorado, can be seen in Table 1.

An interesting feature of this plant was the secondary addition of absorption and fractionation facilities and their effect on liquid recovery. Table 2 is a record of the production of the plant before and after addition of new facilities. In both the before and after cases, gas throughput was well under a million cubic feet, averaging 845,000 before the new facilities were installed and about 800,000 cu. ft. daily afterwards. The sharp increase in recovery of liquids can be seen from October to November with the transition from straight refrigeration to refrigerated-oil absorption. Average gallons recovered per thousand cubic feet on a daily basis jumped immediately from 2.176 to 3.430. Monthly production jumped from 58,000 to more than 82,000 gal. of total liquid, and this is with two fewer plant operating days in November. When these figures are converted to a daily basis, production in October averaged about 1,870 gal. of total liquids per day, and 2,840 gal. in November. In succeeding months, the liquid recovery is even more marked. Daily average production during March averaged about 3,160 gal. of total liquids despite the fact that gas throughput averaged only 755 M.c.f.d.

The economic gain realized from the additional facilities is quite graphically demonstrated by these results.

VERTICAL gas-fired helical coil reboilers are used at the Leader plant.



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Mass spectrometry is proving valuable for evaluations, examinations, research, and process control

MASS-SPECTROMETRY results indicate that the principal components of paraffin wax are the normal paraffins. Branched chain and cycloparaffins are also present, frequently in substantial quantity. Polycycloparaffins and monocycloaromatics appear in much smaller quantity.

Comparison of the mass spectrometer patterns of the waxes with those of pure hydrocarbons indicates that the branched paraffins are largely 2- and 3-methyl alkanes and that the cycloparaffins are largely 1-cyclohexyl and 1-cyclopentyl alkanes.

Tensile strength . . . A special inclined-plane instrument and the Tinius-Olsen method were used for tensile-strength determination. The waxes with higher nonnormal content showed greater tensile strength.

It is quite probable that the nonnormals that make the most effective contribution to tensile strength have a molecular weight considerably higher than that of the normal paraffins making up the bulk of the wax. The nonnormal hydrocarbon content of paraffin waxes that results from conventional refining procedures is usually concentrated in the higher-molecular-weight fractions.

The maximum tensile strength of paraffin wax is associated with optimum content of nonnormal hydrocarbons. Nonnormal hydrocarbons vary in their effectiveness in this respect. The most effective compounds are solid at the test temperature (70° F.) and are of a considerably higher molecular weight than the wax's normal paraffin content.

Process Control at Shell

Two mass spectrometers are used for both process control and research work at Shell Oil Co.'s Houston, Tex., process-development laboratory.

About 40% of the laboratory's work is devoted to running control samples for Shell's Houston refinery. The mass spectrometer is used to analyze gas samples from the plant streams up to the pentane hydrocarbon range, liquid analyses of hydrocarbons and gasoline fractions up to 400° F., and hydrocarbon "type" analyses.

The gas samples in particular must be run very rapidly because plant production control is directly dependent upon the analytical results.

The other 60% of the analytical work is done on samples from various pilot plants. These samples are made up in a large part of hydrogen or an inert gas, and hydrocarbons ranging from C_1 to C_6.

Gas analyses are run on one instrument, while high-boiling compounds are run on the other which had been adjusted for high resolution and equipped with a heated inlet system to vaporize high-molecular-weight hydrocarbons. Sample load sometimes runs as high as 1,500 samples per month. Ninety per cent of all analytical work is done by automatic data-handling instruments, including digital readout equipment and programed calculators.

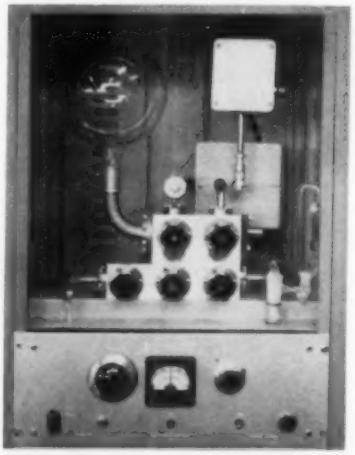
Sinclair Oil

At Harvey, Ill., Sinclair Research and Development Laboratories operate a mass spectrometer for rapid examination of gases and highly volatile petroleum products. The instrument analyzes about 7,500 samples annually. About 65-70% of the samples run are gases, mostly hydrocarbon mixtures containing C_5 and lighter components and mixtures of hydrocarbons and noncondensibles.

The hydrocarbon "type" analysis developed by R. A. Brown and reported in Analytical Chemistry (23, 430-7, 1951) has been applied with great success to petroleum stocks in the naphtha and gasoline-boiling ranges.

Richfield's Watson Refinery

Richfield's Watson refinery (Los Angeles harbor) has an analytical mass spectrometer working on routine controls, catalyst evaluations, and the complete cataloging of stream composition. This instrument during a typical year completes 6,700 individual analyses at a rate of about 30 samples per day.



CLOSEUP of inlet system of mass spectrometer. Sample to be analyzed is contained in the round flask which is connected to system through a tapered fitting. Numbered valves are used to control flow. Pressure is measured by the micromanometer, part of which may be seen under the valves.

Samples from primary and superfractionating units, as well as from cracking, polymerization, and alkylation operations are regularly analyzed. Both overheads and bottoms from depropanizer, debutantizer, and deisobutanizer units are typical of the refinery units monitored.

Efficient control, made possible by the precise analyses obtained, has greatly increased throughput in practically all the standard units at the refinery.

By combining very tight control and highly efficient operation on the superfractionation units, Richfield retains a product of extremely high purity (e. g., normal butane of 99% purity). Isobutane and isopentane of correspondingly high purity and unusually free of butanes are also obtained by superfractionation. The mass-spectrometric classification and determination of their hydrocarbon balances have been of great value in planning their use in the more complex refining operations.

There's a trend to

WELDED PIPING IN SMALL SIZES, TOO

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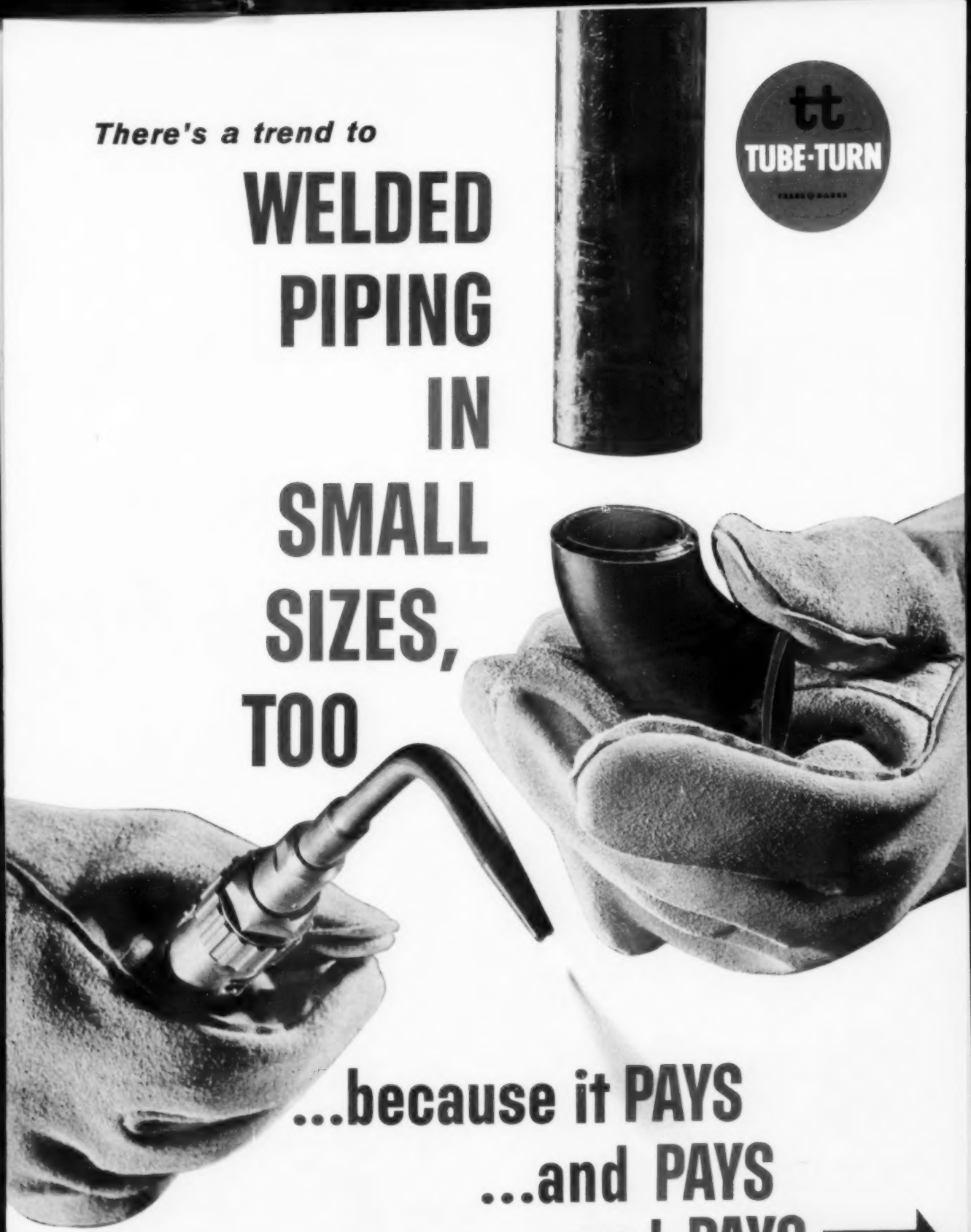

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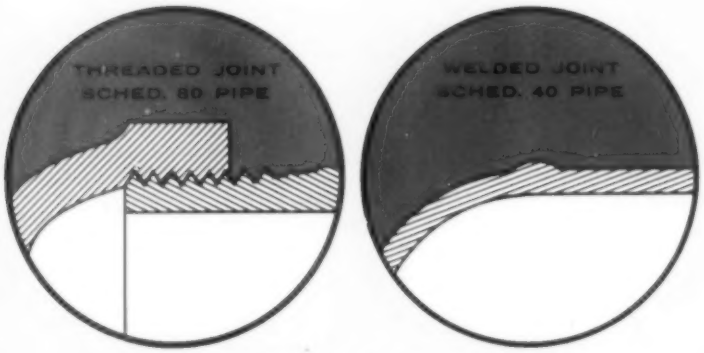
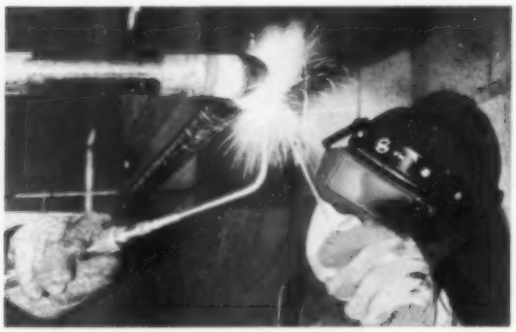
In small sizes . . . all sizes . . .

welded piping with TUBE-TURN® FITTINGS pays off 3 ways!



SAVES ON MATERIAL. Schedule 40 pipe, butt welded, is stronger in bending and fatigue and has greater thickness for corrosion resistance than Schedule 80, threaded. Hence, welding piping can be lighter . . . can cut material costs 30-50%.



SAVES ON INSTALLATION. Butt welded joints in 1½" piping, such as school heating line shown, averages 7 minutes compared to 8 minutes for threading and tightening fitting. Tools are simple, inexpensive.

MORE INFORMATION—"The Economics of Welding Small, Non-critical Pipe" gives helpful information. Mail the coupon for your free copy.

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SAVES ON MAINTENANCE. Butt welded joints are permanently as strong and leakproof as the pipe itself. Photo shows ½" welded water-heat piping for shopping center . . . specified to eliminate maintenance expense.

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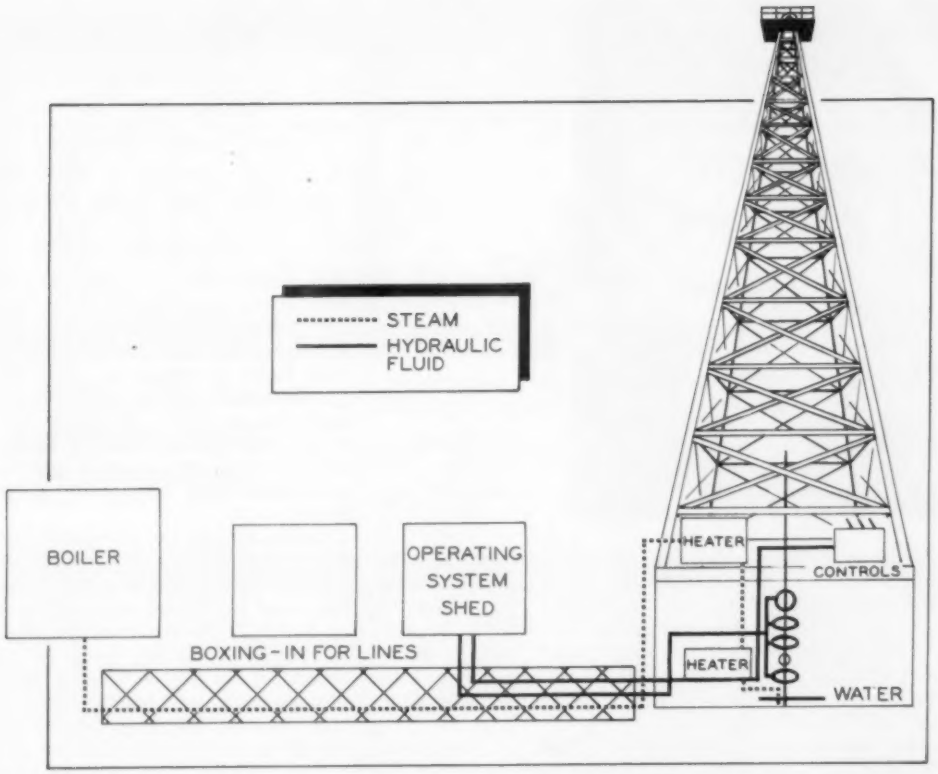
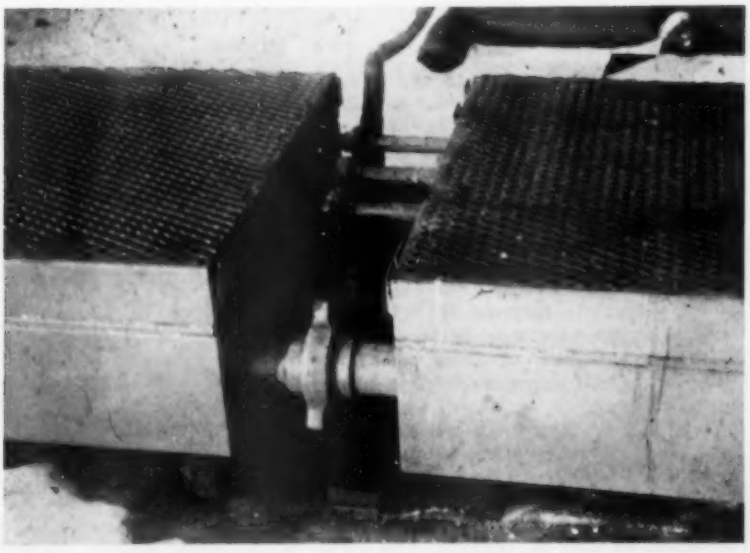


BLOWOUT PREVENTER SYSTEM for cold-country operation uses a special type of hyraulic fluid for . . .

Blowout prevention in cold country

BY DAVID L. BLACK
Petroleum Extension Division
University of Texas, Austin

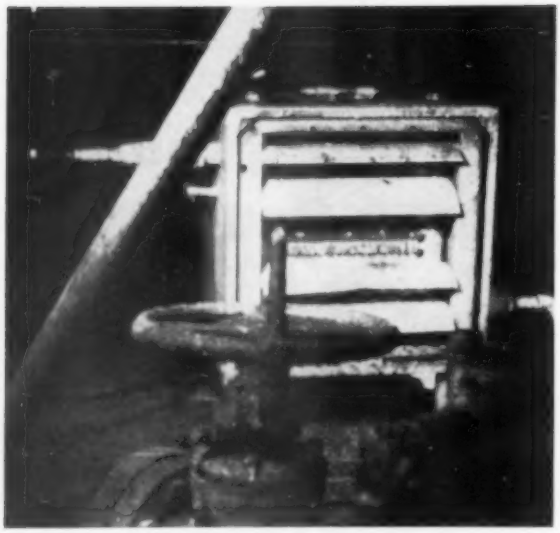


STEAM AND HYDRAULIC LINES. Each steam line is separated by a hydraulic line. This permits the steam to warm the hydraulic lines continually. The boxed-in feature retains the heat.

FREEZING TEMPERATURES are necessary for successful transportation over the Canadian muskeg, for nothing can move unless the moisture in the soil is frozen. The extreme cold, however, brings many problems of preventive action for the blowout-preventer system.

A hydraulic system using mud or water is worthless in below-zero drilling. The only material practical in this situation is hydraulic fluid, and even that must be of a special type, and must be kept warm constantly. Northern companies make hydraulic fluids for operating equipment under such conditions. It is essentially the same as that used in the rest of the drilling business, with the exception that a pour-point depressant is added to it.

Another important item for special attention is the selection of rubber packing and diaphragms for the preventer and accumulators. Synthetic rubber used in temperature zones has a tendency to crack when it is flexed before being thoroughly thawed. Natural-rubber packing and diaphragms



RADIATOR-TYPE BLOWER directs heat on the preventers. The steam line enters the blower at the left and leaves at the right.

work well in such cold climates when they have the proper care.

Very few contractors use rubber or plastic lines for their hydraulic systems. First of all, rubber or plastic grows rigid when exposed to subfreezing temperatures for any length of time. If the lines leak, the preventers might not be able to be closed or a fire can start. Steel lines are more trouble to install and maintain, but they are necessary.

No matter what equipment is used in these areas, it must be kept warm. This applies especially to the accumulator or operating system and the preventers themselves. On nearly all rigs, there is a special shed for the accumulator which has its own heater. Spare parts for the preventer system are stored here.

Lines from the boiler . . . Every rig has to have a boiler for heating purposes. The boiler is usually a good distance from the rig, with steam lines running by auxiliary structures to the rig itself. With very little planning, the lines can pass by the accumulator shed. There, the pipes carrying hydraulic fluid can join the steam lines, and thus be warmed as they go to the preventers.

Contractors have also devised a use for the steam after it has passed through the heaters on the rig floor. From there, the exhaust line can be run down through the substructure and connected to a radiator blower-type heater directed on the preventer stack. From this heater, the steam is channeled into the cellar below the preventers, where waste mud, water, or slush can be warmed and heat the bottom of the preventer stack.

Panels around the substructure are a common sight where rigs are drilling in cold weather. Besides keeping the wind and snow out from under the substructure, they also serve to keep the heat in. However, they should be constructed so that they can be taken off in a hurry, for it might be necessary to reach the preventers from some other entrance than the door.

Keep constant check . . . Testing and inspecting the preventer equipment has to be on a rigorous basis. A complete inspection every 24 hours is necessary. When the inspection is completed, the tool pusher should check the equipment to be sure it is working properly. Before testing, however, he should make sure that all parts are completely thawed and clean. A steam hose is a good tool for quick thawing, since it cleans the preventers and at the same time effectively thaws them. Mud should be circulated for some time before closing the preventers to be sure that the packers and rams are thoroughly thawed.

Moves take care . . . One common error among contractors leads to much unnecessary expense. During the moving opeartions, the preventer equipment has to be adequately protected. At this time, the equipment has a much greater chance to freeze than at any other period. There is usually no heat in the storage area, and the temperature may vary greatly in 24 hours.

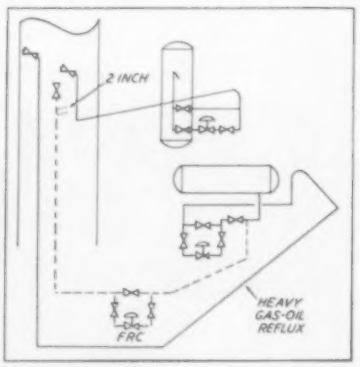
Before storing the preventers outside or leaving them in subfreezing temperatures for any length of time, they must be drained and cleaned of all hydraulic fluid. When the stack is taken down, cleaning the preventers inside and out is good practice. After the preventer is completely cleaned and drained, the hose connections should be covered with blind plugs to prevent dirt or other material from plugging up the line. Some sort of covering should be put over the flange surfaces, for a very small scratch can cause much future trouble.

Wash system clears gas oil

A HEAVY gas-oil wash system on atmospheric towers will reduce the amount of poisonous nickel and vanadium in the gas-oil charged to catalytic cracking units.

The heavy atmospheric gas-oil wash stream is injected about four trays below the bottom side draw from the atmospheric tower. In this manner, most of the nickel and vanadium in the charge stream will be carried downward into the bottoms of the tower which are then charged to the deasphalting plant. About 75-80% of the Ni-Vd will be removed this way leaving the gas-oil charge to the cat cracker much freer of these contaminants, which are especially harmful to catalyst.

In the charge streams to two towers, nickel content on a wet-ash basis amount to 0.07 lb. per 1,000 bbl. and 0.05 lb. per 1,000 bbl. respectively. Removal of 75% of the nickel amounted to 0.45 lb. per day. This nickel was added to the deasphalting charge stream along with the increment of process gas oil lost to residuum as a result of its washing action. The increment of gas oil amounted to about 500 bbl. per day in this case. The economic loss sustained thereby is more than recovered by improved catalyst performance and longer life.



Method suggested by F. K. Hayes and H. A. Otto, helpers; courtesy Humble Oil & Refining Co., Baytown, Tex.

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CUSTOMER: What are "ton-miles" per gallon?

DEALER: That's the distance one gallon of gasoline will move one ton of automobile. It takes into account the varying weights of today's cars.

CUSTOMER: That sounds reasonable, but what does it prove?

DEALER: That with today's gasoline, you drive a real bargain! Measured by the "ton-mile," today's gasoline does 70% more work than gasoline did in 1930.

CUSTOMER: 70%? That's a terrific improvement in gasoline performance.

DEALER: Right! In 1930, the average car on the road gave 25 "ton-miles" per gallon. Today, the average is 43 "ton-miles."

CUSTOMER: But how about the cost of gasoline per gallon?

DEALER: You gain there, too! In 1930, you spent ⅔ of a cent for gasoline for each "ton-mile." Today, you spend only a little over ½ a cent for each "ton-mile" you drive.

DEALER: *You're getting 70% more work out of your gasoline, and you're saving 18% while you do it!*

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REMEMBER OIL PROGRESS WEEK—OCTOBER 12th to 18th

Save money on workovers by using a

Light rig for concentric-tubing jobs

BY ED McGHEE
Drilling Editor

CONCENTRIC-TUBING workover rig on platform in Bay Marchand. This rig, with 65-ft. mast, can be used to perform many services on wells, and eliminated the high cost of moving and maintaining an expensive rig. This rig is . . .

IF THE RIG pictured on these pages is like nothing else you've ever seen, there's a reason for it. It's one of only a handful of such rigs ever assembled.

The rig belongs to Rebel Well Service of Houma, La. Its job is to work over wells using ¾-in. tubing. The rig does not pull the production string; instead, the ¾-in. workover pipe runs inside the production tubing. For that reason, the jobs done by such rigs are called "concentric-tubing workovers."

Fig. 1 shows Rebel's rig at work on a platform at Bay Marchand. The small size and packaging of this rig make it a real money saver for such offshore jobs. And, many of the concentric-tubing jobs to date have been on water locations. However, the method can be just as valuable—or even more valuable — on land locations.

NOT DESIGNED for heavy rotating or drilling, so ¾-in. tubing is used. This is light enough so that one man can easily handle one joint at a time. Since sand clean-outs are a one-trip operation, there's no need to pull doubles or to stand the pipe on the mast. This lightweight tubing can be easily pulled using . . .

A REGULAR Wilson double-drum pulling unit. It has been skid-mounted to be easily moved onto offshore platforms.

Now on contract basis . . . Gulf Oil Corp. pioneered the concentric-tubing principle in its South Louisiana operations; a complete report on Gulf's work appears on page 80 of the April 28, 1958, issue of The Oil and Gas Journal. When Gulf was so successful in its cleanouts and plug-backs with concentric tubing, other companies tried the idea. Now it is used widely in South Louisiana and is spreading to other areas.

Several firms are now contracting to do concentric-tubing workovers; Rebel Well Service is prominent among these. Besides the skid-mounted rig shown in these pictures, Rebel has a barge-mounted rig which can be submerged to work on wells in shallow water.

A year's service . . . Fig. 2 shows a string of Rebel's ¾-in. J-55 EUE tubing on location. The company's first string of such tubing lasted for 14 months in intermittent service. A year's service is likely all that could be expected of a string in normal contract usage.

Gulf reported only 4 tubing failures in 71 jobs with such a string.

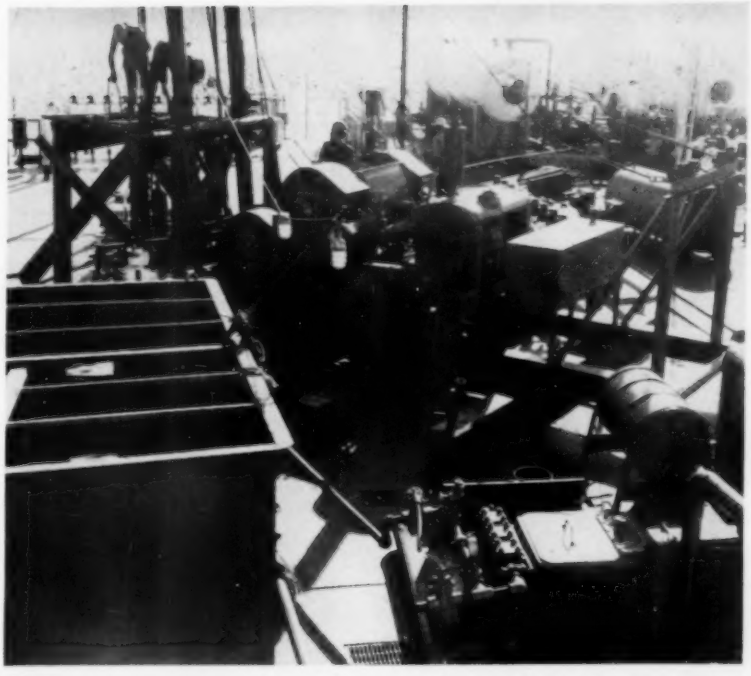
Not meant for heavy rotating or drilling, the ¾-in. pipe serves mainly as a channel for circulating to the bottom of the hole. Sand is removed by regular and reverse circulation; acid is circulated to remove set cement. Various-type shoes are run on the bottom of the string depending on the operation being done.

If conditions are not too severe, practically any workover job can be run on a well having suitable tubing installation. Satisfactory results have been obtained on sand removal, squeeze cementing, displacement plug cementing, set-cement removal, acidizing, and combination jobs.

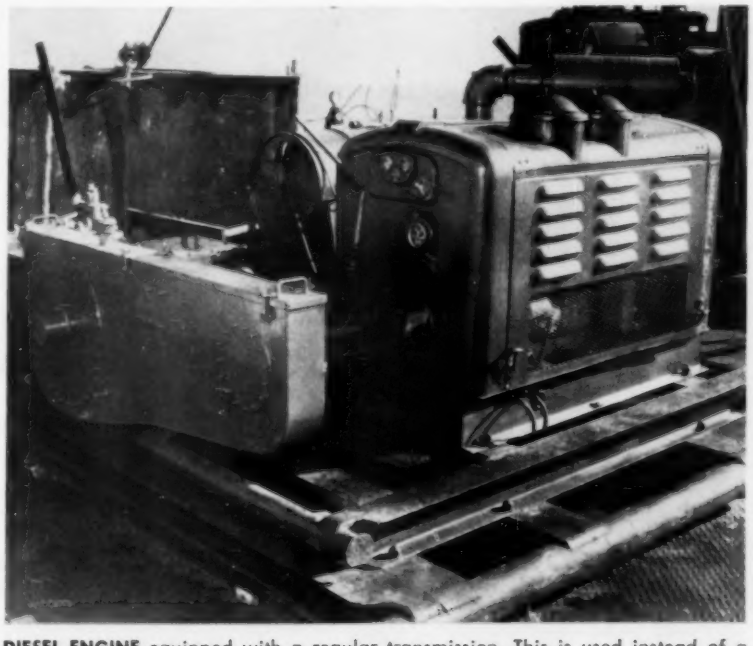
Of course, the ¾-in. pipe is light enough that a man can handle a joint of it easily. As Fig. 2 shows, it can be picked up on the trip into the hole and laid down on the trip out of the hole just as if it were a string of sucker rods. Besides, since cleaning out is a one-trip operation, the pipe would have to be laid down to move off. For that reason, there's no great need to pull doubles or to stand the pipe in the mast.

Regular pulling unit . . . The draw works is a regular double-drum pulling unit. Besides handling the ¾-in. string, the unit can swab the well back into production after a workover is completed. As Fig. 3 shows, the unit is skid-mounted with a 65-ft. mast which lays down over the unit for moving.

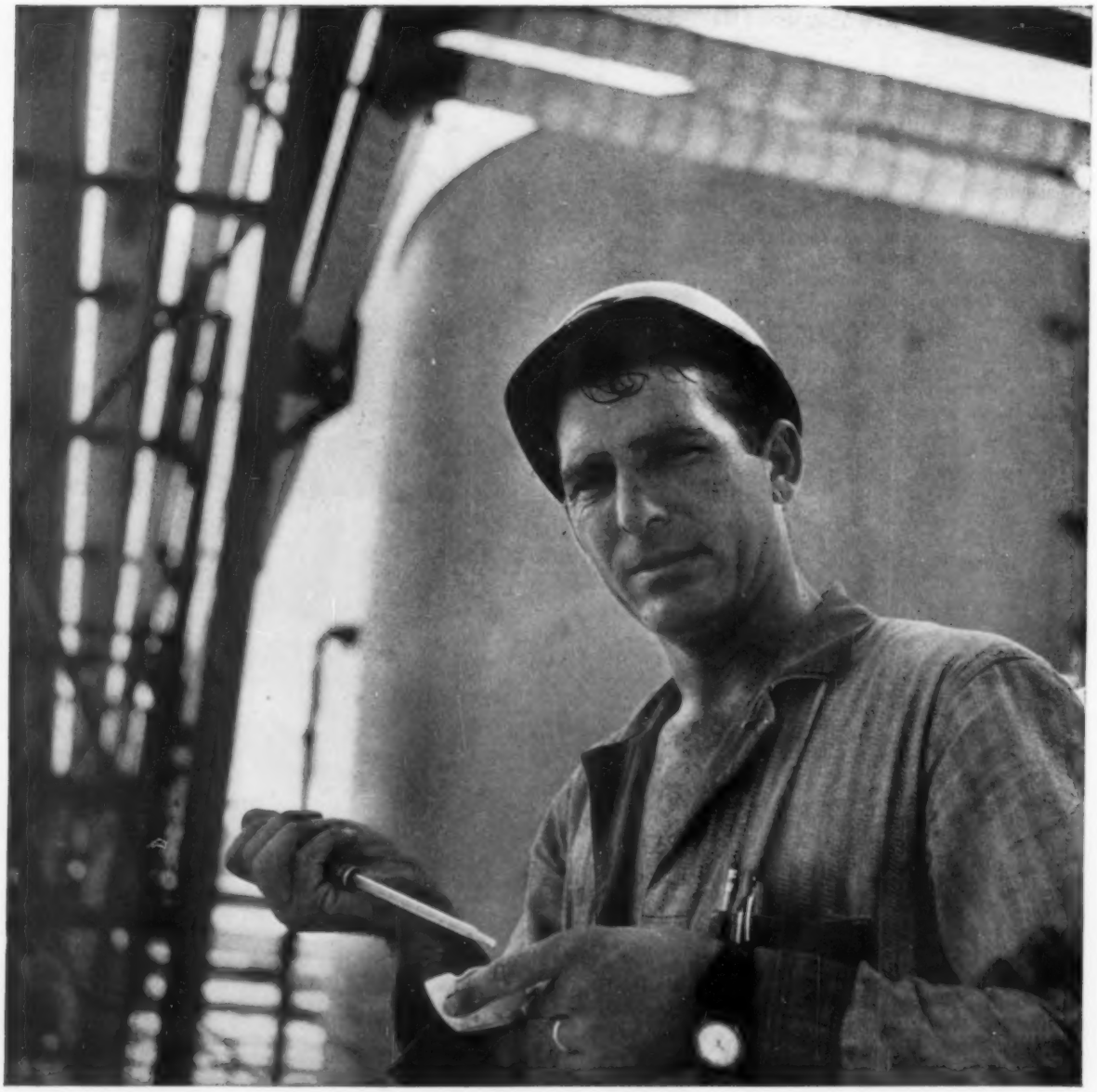
In the foreground of Fig. 4 is the rig's Gardner-Denver PE-5 triplex pump. This pump, as well as the pulling unit is powered by a diesel engine driving through a chain. As Fig. 5 shows, the engines use a regular transmission instead of a straight-drive clutch. Reason for this is the wide range of pressure required from the pump. Rated at 6,000-psi. working pressure, the pump may be called



REBEL'S triplex pump is rated to 6,000 psi. to take care of the high-pressure loss due to the small pipe. The tank is compartmentalized to allow sand to settle out on a cleanout job, and calibrated so that fluid can be spotted accurately in the well. The pump is driven by a . . .



DIESEL ENGINE equipped with a regular transmission. This is used instead of a straight-drive clutch because of the wide range of pressure that is required from the pump. A Gardner-Denver 5 by 8 pump is used for mixing mud and as a standby for the triplex.



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With Dowell Service you receive the benefits of more than fifteen years experience in chemical cleaning—plus special equipment, chemicals, research and trained personnel. You pay one charge, get an efficient job, handled by knowledgeable people.

Every industry can profit from Dowell Service. Ask your maintenance and operating engineers if they have thoroughly investigated the profit possibilities of using Dowell Service. DOWELL—A SERVICE DIVISION OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma; 165 offices and stations to serve you.

Chemical cleaning service for industry DOWELL

on for as little as 1,500 psi. at 5,000 ft. or as much as 3,500 psi. at 8,000 ft.

Reason for the high pressures is, of course, the big friction loss in the ¾-in. pipe. However, since the production tubing is in place during the job, no high pressure is thrown onto the well casing even during reverse circulation.

The tank in Fig. 4 is divided into compartments so that the sand can settle out away from the pump suction. The tank holds 150 bbl. and is calibrated so that fluid can be accurately spotted in the well.

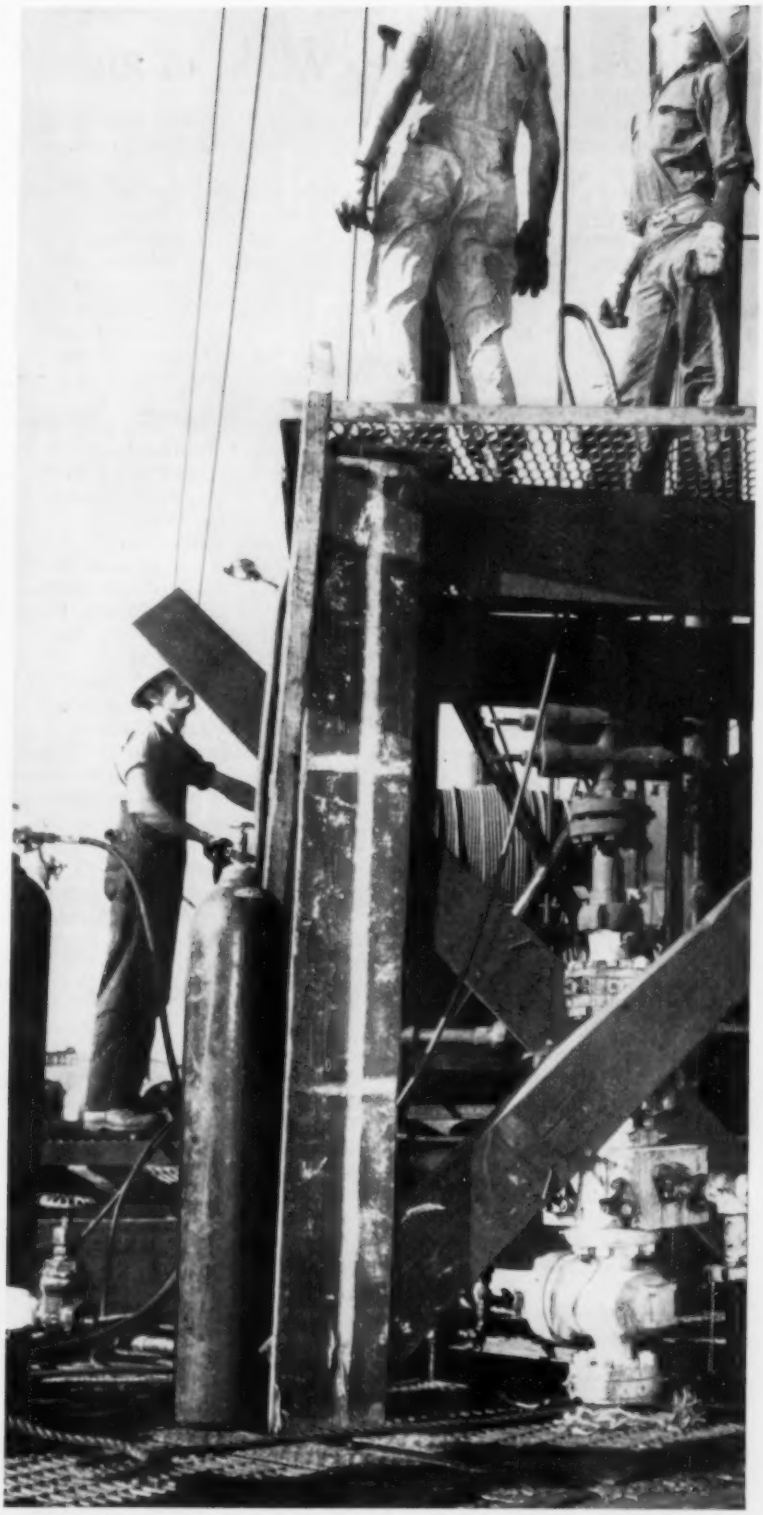
For use in mixing mud or salt water, the rig has a Gardner-Denver 5 by 8 pump.

For reverse circulation . . . To guard against blowouts and to make reverse circulation possible, the rig carries a 2½-in. i.d. ram-type Bowen wire-line preventer. This carries two sets of ¾-in. rams. Fig. 6 shows this equipment. Above the ram-type preventer is a Hydril wire-line stripper.

The preventer rams are worked by hand; the Hydril stripper is operated by bottled-gas pressure. Fig. 7 shows a cylinder of nitrogen at the wellhead which will operate the stripper if needed.

The substructure on the particular job shown by Fig. 7 was fabricated on the platform from wood timbers. On many platforms, the wellheads are on a lower level so that no substructure is necessary.

AS SAFEGUARDS against blowouts and to make reverse circulation possible, a hand-operated ram-type blowout preventer and a Hydril wire-line stripper are used. The wire line . . .



STRIPPER is operated by the nitrogen cylinders on the left. The substructure shown here was fabricated on the job; on many offshore platforms, the wellheads are on a lower level so that no substructure is necessary.

Texas' Hidalgo County Works 15 Rigs

ONE of the largest arrays of medium-depth and deep-drilling contract rigs in South Texas continues to operate in Hidalgo County, in the Rio Grande Valley.

Hidalgo County, particularly its southern portion along the Mexican border, has been the scene of more or less active and steady drilling, both exploratory and development, for several years.

More than 15 rigs now are running in this county with a dozen contractors sharing in the work. Present work is spread over 10 different areas but all in the south half of the county.

In present operations, Monte Christi Drilling Co. leads with three rigs running. One is drilling on a 11,500-ft. wildcat in the Hargil area, on the east edge of the county, near the Willacy County line. Another is in the North Monte Christi field, where it is under contract to Tennessee Gas Transmission Co. on 10,000-ft. drilling. The third is working for Northern Pump Co. in the North Weslaco area.

Viking Drilling Co. and Coastal States Drilling Co. have two rigs each busy in the county. Viking is drilling for Union Producing Co. in Shepherd area, south of Pharr, with 7,500-ft. objectives. One Coastal rig is working for Harrell Drilling Co. in Donna field, an 8,000-ft. operation. The other is on a 7,800-ft. well for C. L. Wright in Whitted field, 2 miles north of McAllen.

Holmes Drilling Co. has the deepest projected operation, a 14,000-ft. well for Shell Oil Co. in Javelina field, 15 miles north of Sullivan City, on the Starr County line. In the same area, General Well Drilling Co. has been drilling for Phillips Petroleum Co., for which company it has just completed a good 5,575-ft. oil producer.

Well Drillers, Inc., has a rig working for Union Producing Co. in the Shepherd area, augmenting the two rigs Viking Drilling Co. is running for Union in the same field.

Kirkpatrick Drilling Co. and Voss Drilling Co. have a rig each drilling for V. H. Neuhaus at North Weslaco, where Monte Christi Drilling Co. is drilling for Northern Pump Co. All have 10,000-ft. contracts.

Stewart & Gouger Drilling Co. is on a 9,700-ft. job for Pan American Petroleum Co. in La Blanca field. Gilmour Drilling Co. is in Tabasco field, in the southwest corner of the county, where it is working for Harry L. Martin. Flourney Drilling Co. is finishing up on a 4,400-ft. gas-condensate well it drilled for C. G. Glasscock and Tidelands Oil Co. and others in Flores field, north of Sullivan City.

Who's getting the drilling contracts

Fortenbery Drilling Co., Natchez, Miss., has a rig working for Norman Germany, of Dallas, and G. W. Gulmon, of Natchez, in the recently opened producing area northeast of Omega field, in Concordia Parish, eastern Louisiana. Its location is 1,050 ft. southeast of the area's discovery well, completed last July with oil production from a 5,130-ft. Wilcox sand.

Del Mar Drilling Co., Corpus Christi, is drilling a 9,000-ft. exploratory test in the Albrecht area, in northwestern Goliad County, in Texas' central coastal region. It is contracting for DDG Gas & Oil Corp., of San Antonio, with an operating interest in the project. Location is on the M. J. Ybarbo Survey at 1 Ramsey.

Rowan Drilling Co., Houston, will be the contractor on a deep offshore wildcat Continental Oil Co., as operator for the CATC group, will drill in Block 199, Ship Shoal area, in the Gulf of Mexico, off the coast of Terrebonne Parish, Louisiana. The project is 1½ miles south of a shut-in gas well (Block 176 field) drilled by Gulf Oil Corp. in 1956, and more than 50 miles from nearest land point. Gulf's Block 176 discovery in Louisiana's farthest offshore fields.

Neal Drilling Co., Victoria, Tex., is getting well down on a newly started deep test it is drilling for Southern Minerals Corp., of Corpus Christi, at a wildcat location a mile northwest of Old Ocean, in Brazoria County, Texas Gulf Coast. Plans call for a 11,000-ft. test. Location is at 1 Holland, in the Polly & Chance Survey.

Big Six Drilling Co., Houston, has an 8,000-ft. contract job under way about 4 miles east of Cypress, in Harris County, Texas Gulf Coast. Operator is W. C. Dunlap, Jr., of Houston. Location is at 1 Wedell-Rustenbach Unit, in the A. Bodin Survey.

Carl B. King Drilling Co., Midland, Tex., is on a new deep-drilling job for Union Oil Co. of California in southern Eddy County, New Mexico. Location, at 1-9 Crawford "B," in 9-24s-27e, is 7 miles west of Malaga. It is 4 miles southeast of Black River field. Permit is for a 12,500-ft. test.

Field Drilling Co., San Antonio, has a new contract operation going about 15 miles south of Tilden, in McMullen County, Southwest Texas. It is a contract job for W. Earl Rowe, also of San Antonio. Location is on the Harry Brown ranch, in the Maria del Plier Perieda Survey. A 7,100-ft. test is planned.

A. W. Williams Drilling Co., Mobile, Ala., is going to drill a wildcat 35 miles northwest of nearest production in far-western Mississippi. It is to be a 4,650-ft. Lower Cretaceous test for Cities Service Production Co. in Washington County, opposite Chicot County, southeastern Arkansas. Location, at 1 Ingram, in 28-16n-6w, is about 3 miles northeast of Hollandale. Nearest production is in Tinsley field, to the southeast.

Loffland Brothers Co., Tulsa, is drilling for Pure Oil Co. on a newly started wildcat in the southwestern corner of Grand County, in southeastern Utah. Its location is at 1 USA-Mineral Point, in 7-26s-18e, on the east bank of Green River, about 8 miles southwest of the Big Flattop area. Pure has scheduled a 7,800-ft. Mississippian test.

Prime Drilling Co., Wichita, and **L. C. Smitherman Drilling Co.,** Augusta, Kans., are the contractors on two new wildcat drilling jobs in western Kansas' Hodgeman County. Prime is drilling a 5,000-ft. Mississippian test for Barbera Oil Co. about 18 miles southwest of Jetmore in the southwestern corner of the county, ½ mile east of the Gray County line. Smitherman is on a 4,600-ft. test 8 miles northwest of Jetmore with Fred J. Ayesh as operator. Its location is 1½ miles northeast of Hallet pool.

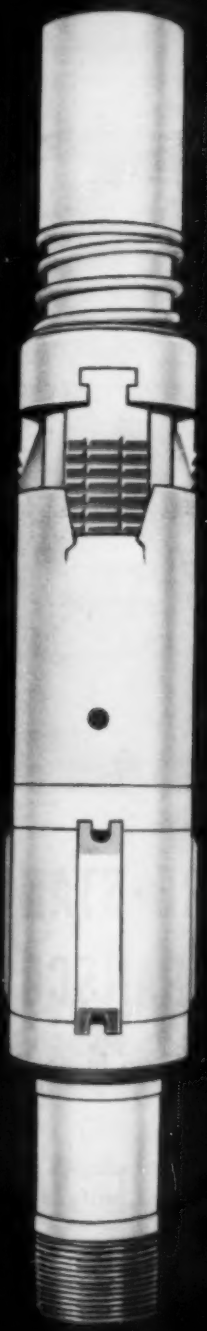
Delta Drilling Co., Tyler, Tex., is under contract to Bel Oil Corp., Lake Charles, La., for a 11,500-ft. test at a wildcat location 1½ miles southeast of La Pice field, in western St. James Parish, southeastern Louisiana. Its location is for 1 Waguespack, in 81-12s-15e.

INCREASES PRODUCTION by eliminating tubing breathing and buckling, thus lengthening the effective pump stroke and raising volumetric efficiency. While it is often difficult to determine exactly how great such increases are, many operators have told us that they have experienced as much as 50% gain.

GREATLY REDUCES ROD, TUBING AND CASING WEAR by eliminating the chief causes of such wear—tubing breathing and buckling. Many Baker Compensating Tubing Anchors, installed over a year ago in wells that **had been** averaging as high as 18 rod jobs per year, have been in continuous use ever since—**with no rod jobs yet!**

AUTOMATIC OPERATION eliminates the need for involved calculations and the application of tension from the surface. Since the Anchor is designed to allow only downward movement of the tubing, the exact amount of tension required to eliminate both breathing and buckling is automatically applied by the natural elongation of the tubing itself.

SAFE, POSITIVE RELEASE is accomplished by merely rotating the tubing to the right. There is also an emergency release, in the form of a Shear Ring, for extreme conditions.



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BAKER
MECHANICAL COMPENSATING TUBING ANCHOR
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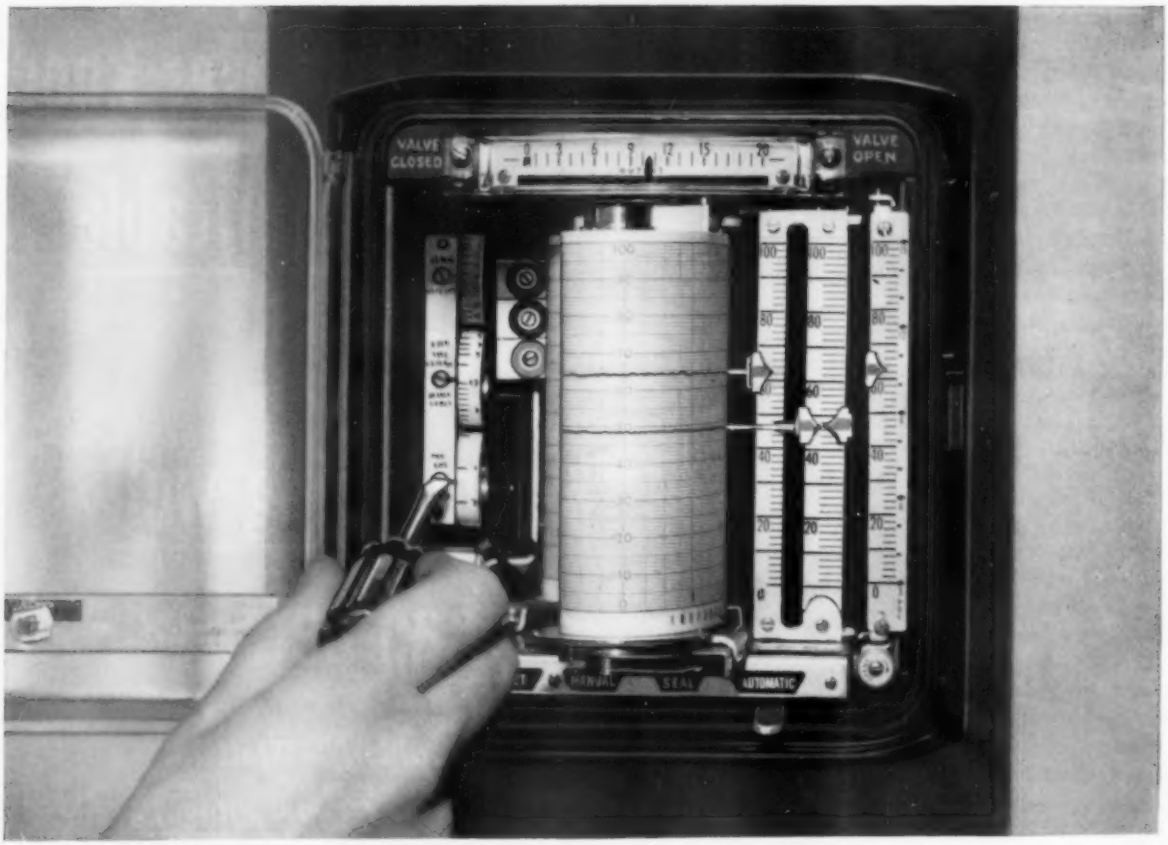


WHY USERS ARE STANDARDIZING ON THE TAYLOR TRANSCOPE* RECORDER

Never before so many features in so little panel space!

1 All settings and adjustments made from front. Results are immediately obvious and the record is uninterrupted. Control response adjustments —when a TRANSCOPE Controller is mounted on the rear of the recorder—can be made with a screwdriver *without going behind the panel board.* Gain, reset and PRE-ACT* dials are calibrated in specific units.

This elimination of 'blind adjustments' is typical of the attention to detail that has gone into the design of the 90J series Recorders.

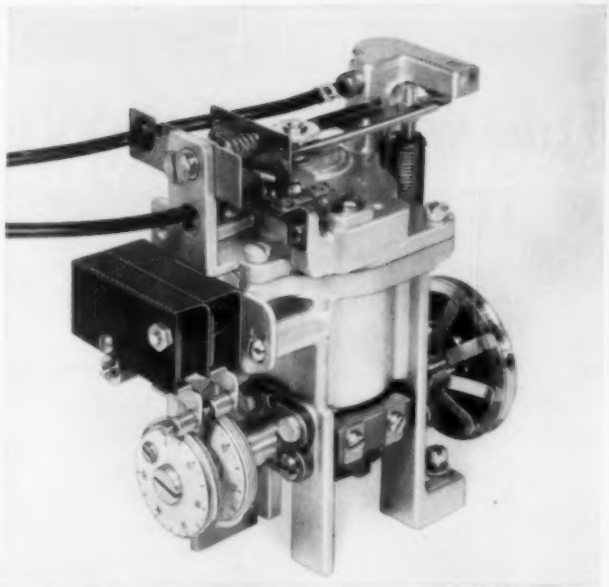
Also color-coded, adjustable signal-dampers (one for each recorded variable) are easy to get at, located right behind the chart drive.

2 Plug-in design. All principal assemblies are plug-in mounted for flexibility and easy accessibility. Individual unit parts are interchangeable.

3 Left-to-right record. 4″ rectilinear strip chart travels from right to left for easy reading. Gives continuous 30 day record (optional 24 hr.)—3 hour visibility. Most dependable chart drive ever devised—available in electric or pneumatic form. Pneumatic impulse twice as smooth as in conventional impulse drives.

4 Bumpless Automatic-to-Manual switching. Air leakage while switching is eliminated by an ingenious "O" ring slide valve. Selector lever travel is limited by mechanical stops, insuring positive positioning.

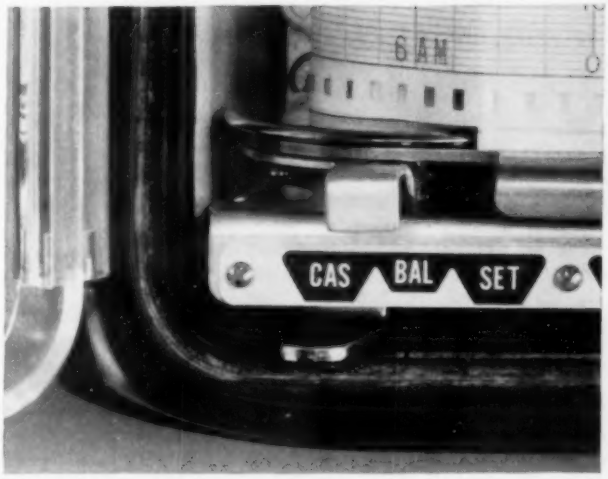
5 More accurate records. The Servomatic ▶ Motors give precise pen positioning. Essentially a power piston with a built-in positioner, the servomatic motor is the heart of the TRANSCOPE Recorder. Delivers 150 times more power than the conventional bellows type actuation, insure lifetime accuracy and sensitivity, a minimum of maintenance. *Servos are sensitive to changes of less than 0.1% in the pneumatic signal.*



6 Process Alarms provide built-in protection. ▶ As many as six process alarms can be incorporated in one recorder housing. Attached to the servo drive shaft, they may be either electric or pneumatic. Alarms are available in various combinations and may be set for high level, low level or band.

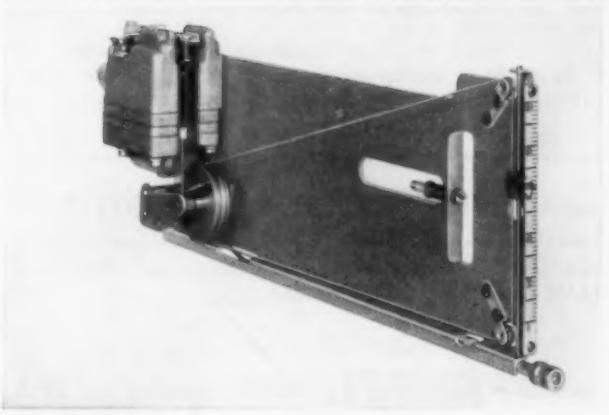
7 A Complete Cascade System in one case. ▶ The 90J Recorder was the first to incorporate a complete cascade system in one recorder case in a 6″ panel cut-out. It provides the simplest, smoothest process start-up. There are no external switches or relays. (Note unique Cascade-Balance-Set Switch.) Master and secondary variables are continuously recorded. Master and secondary controller outputs, as well as set points, are continuously indicated.

This outstanding feature of the 90J Recorder means substantial savings in instrument costs, panel space, operator's time.



8 Unique Set Point Transmitter allows continuous control. ▶ The 90J Recorder's Set Point Transmitter is a complete plug-in unit, separate from the main recording mechanism. Thus when the recorder slide is removed for checking the transmitter remains plugged into housing, keeping the process on uninterrupted, fully automatic control.

Thanks to this exclusive TRANSCOPE feature there's no need for process down time for instrument inspection or servicing.



See your Taylor Field Engineer, or write for ***Catalog 98286***
Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ontario

*Trade-Mark

Taylor Instruments MEAN ACCURACY FIRST

This week's SHOWCASE features . . .

Portable inflated-wall housing

. . . can be inflated in 5 minutes to form a rigid, self-supporting, load-bearing structure, the maker reports. A dome-shaped structure, it is not air-supported and does not require a constant supply of air from a blower.

The structure is supported by pneumatic panels of neoprene-coated nylon fabric less than 3 in. wide. Though inflated simultaneously, the panels maintain pressure individually. Once the unit is erected, the air pump can be disconnected and the windows and door kept open or closed.

Called the Geodome, it is light enough to be lifted by two men. Yet it is sturdy enough to withstand winds with velocities of up to 120 m.p.h. and snow loads of up to 30 lb. per sq. ft. Deflated, it can be folded to fit in a jeep or small station wagon.

Two models are available. One has a 16½-ft. diameter and 218 sq. ft. of floor area. The other has a 48-ft. diameter and a floor area of 1,810 sq. ft. **Write or call: Berger Brothers Co., New Haven 7, Conn., for details on Geodome.**

●

Compound inhibits formation scale

. . . and costly scale deposits in tubular goods. The compound is called SP-2. It's a sodium calcium polyphosphate compounded to inhibit scale crystallization.

When placed in the formation in combination with fracturing sand, or with oil alone, the compound conditions the water in and around the pay zone to check crystal growth. It thus reduces clogging danger in the formation and tubular goods by attacking scale crystals before they reach the formation face. **Write or call: Halliburton Oil Well Cementing Co., Duncan, Okla., for details on Scale-check SP-2.**

●

Computerized process-control system

. . . permits control decisions to be made at rates which match the time constants of a process and the system involved. The new Libratrol 500 system is developed around a rapid-response digital computer. It gives a full range of process control, from accurately processing data that provides understandable information to a human operator, to complete automatic control of the entire process.

Based on a building-block concept, the system offers a single system with a capacity to accommodate expanding functions. Gradual changeover from manual process control to a completely automatic, computer-controlled plant can be made without replacing the system.

The system receives information from monitoring devices, processes it through a computer, and provides accurate control information—either to the human operator or to control elements. It takes inputs from commonly used process instruments.

The computer uses the binary code. Translation from analog signals is performed by a conversion unit in the system. Output signals may be presented as typewritten data, monitor display, alarm lights or bells, or as correcting signals to operate controllers within the process equipment. Input rate of the computer is 200 data words of 31-bit length per second. **Write or call: Librascope, Inc., 808 Western Avenue, Glendale 1, Calif., for details on Libratrol 500.**

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

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COMPANY.....

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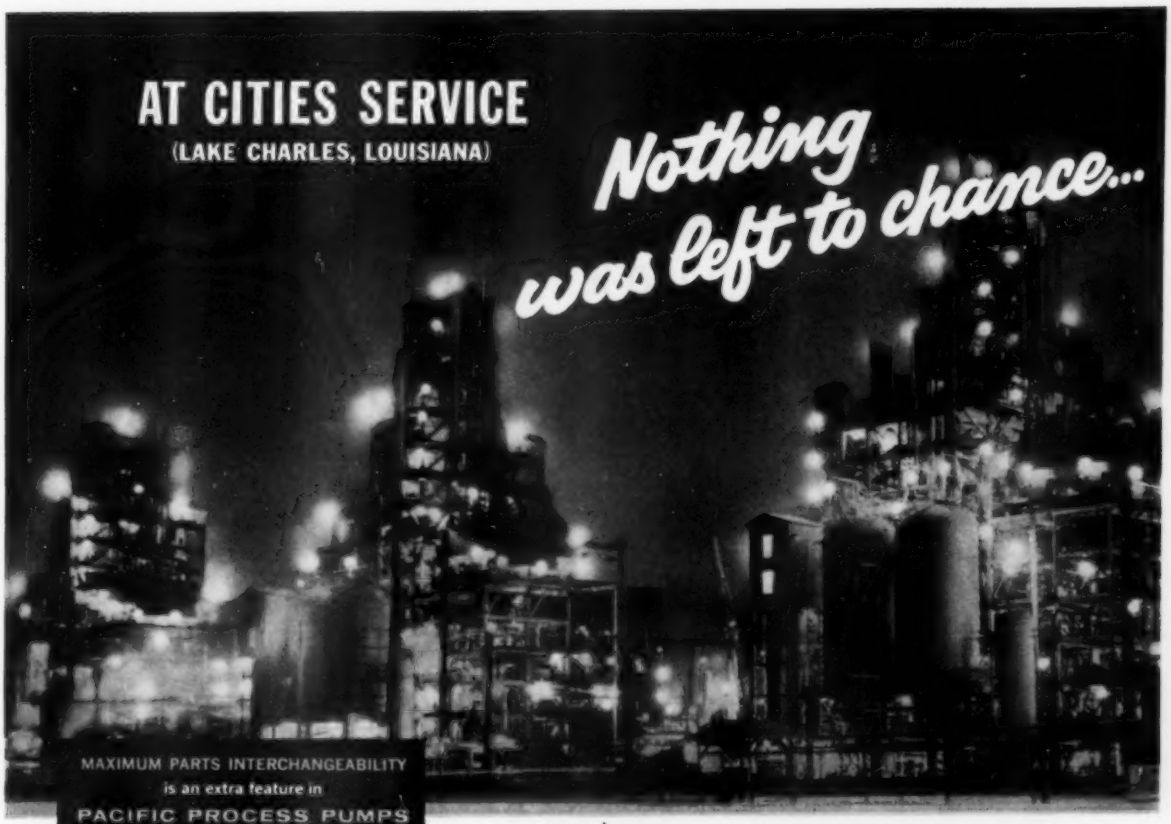

MAXIMUM PARTS INTERCHANGEABILITY
is an extra feature in
PACIFIC PROCESS PUMPS

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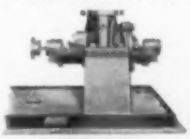
To 850°F.—25 to 3200 GPM
To 600 PSIG—To 650 DIFF. HD. FT.



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To 850°F.—600 to 4500 GPM
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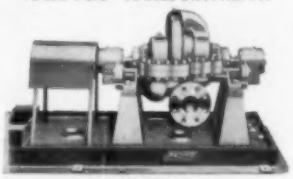

TYPE RHC
To 500°F.—50 to 3000 GPM
To 700 PSIG—To 1300 DIFF. HD. FT.

TYPE AC
To 850°F.—100 to 2500 GPM
To 1000 PSIG—To 2600 DIFF. HD. FT.

PACIFIC PROCESS PUMPS *in service:*

CITIES SERVICE REFINERY	306
PETRO-CHEMICAL, INC.	138
CIT-CON, INC.	137
TOTAL	582

The three fluid catalytic crackers illustrated have established new records for continuous operation since going on stream. Under the most demanding service conditions, all three units came through remarkably. Number two unit operated for 1058 consecutive 24-hour days only to be outdone by its sister unit with a record of 1065 days continuous operation. We feel that the 100% Pacific installation (including slurry pumps) contributed to making these run-records possible.

Elsewhere throughout Cities Service, P.C.I. and Cit-Con operations, Pacific process pumps are delivering equally dependable 'round-the-clock service...convincing evidence that "nothing was left to chance."

Write for Complete Line Bulletin 1C plus individual bulletins for pumps illustrated in panel.

PACIFIC

PACIFIC PUMPS INC
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HUNTINGTON PARK, CALIFORNIA

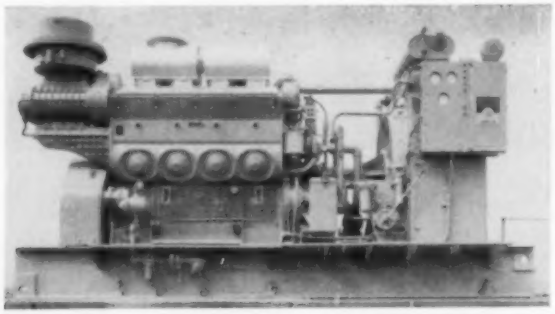
CP-20

Executive plane carries 2,150 lb.

. . . useful load and has a gross weight of only 6,000 lb. The new Aero 500 plane is powered by a 250-hp., 0-540 Lycoming, wet-sump, direct-drive engine. A five-to-seven-place craft, its high-speed rating is 218 m.p.h. Rated cruising speed is 205 m.p.h. Service ceiling is 21,375 ft. Range with a 30-minute fuel reserve is 1,100 miles.

Instruments are finished in black to eliminate glare and they are "eyebrow-lighted" for easy reading. They're grouped for easy access by the pilot and copilot. Optional seating arrangements provide for five to seven persons. Seats are foam-filled. List price for the plane is $64,750.

Besides the Model 500, a new craft with a 3,025-lb. useful load is also available—the Model 680-E. Powered by a Lycoming 340-hp. engine, it features a functional three-section instrument panel. Its high-speed rating is 255 m.p.h. Rated cruising speed is 226 m.p.h. Service ceiling is 25,360 ft. Range with a 30-minute fuel reserve is 1,400 miles. List price is $94,500. **Write or call: Aero Design & Engineering Co., Bethany, Okla., for details on Models 500 and 680-E aircraft.**



Diesel-powered crude-pumping unit

. . . is rated at 900 hp. and is a self-contained unit. It was built to move crude oil from storage tanks into tankers.

Designated SK-10, the unit employs an eight-cylinder diesel with all accessories, including the fan and radiator, mounted on a skid. Over-all length is 18 ft. Width is 7 ft. 8 in., and height is 9 ft. 8 in. over the air filter. Dry weight is 31,500 lb. **Write or call: Electro-Motive Div., General Motors Corp., La Grange, Ill., for details on SK-10 crude-pumping unit.**

•

Swab cups changed without tools

. . . in only 10 seconds on this new knuckle-joint tubing swab, the maker reports. The cups can be changed on the floor or in the derrick. The swab and sinker bars don't have to be laid down to make the change. The swab may be easily converted to a multicup swab by just adding an upper mandrel and cup for each extra cup desired.

Full 360° swivel action is allowed at the bottom socket joint and a minimum 5° knuckle action independently at each socket joint. The cups are free to swivel and float on the mandrel, serving as both a cup and as valves.

The tubing swab comes in sizes of 2 or 2½ in. with a 1¼-in. pin. **Write or call: Guiberson Corp., one of the Dresser Industries, P. O. Box 1106, Dallas, for details on knuckle-joint tubing swab.**

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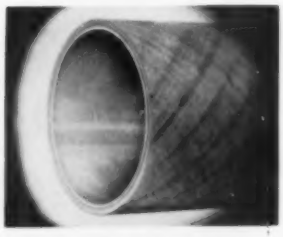

Plastic pipe for downhole use

. . . combines two types of plastic tubing to obtain the properties required for downhole operation. Called Omega, the liner uses a poly-vinyl chloride extruded tube for the internal surface. The exterior of this tube is wrapped with helically interwoven, continuous filaments of glass fiber. The glass is applied under tension, thoroughly impregnated with thermo-setting epoxy resins, and heat-cured.

Advantages cited for the pipe include high resistance to internal and external pressure, corrosive attack, elevated temperature, and aging. The

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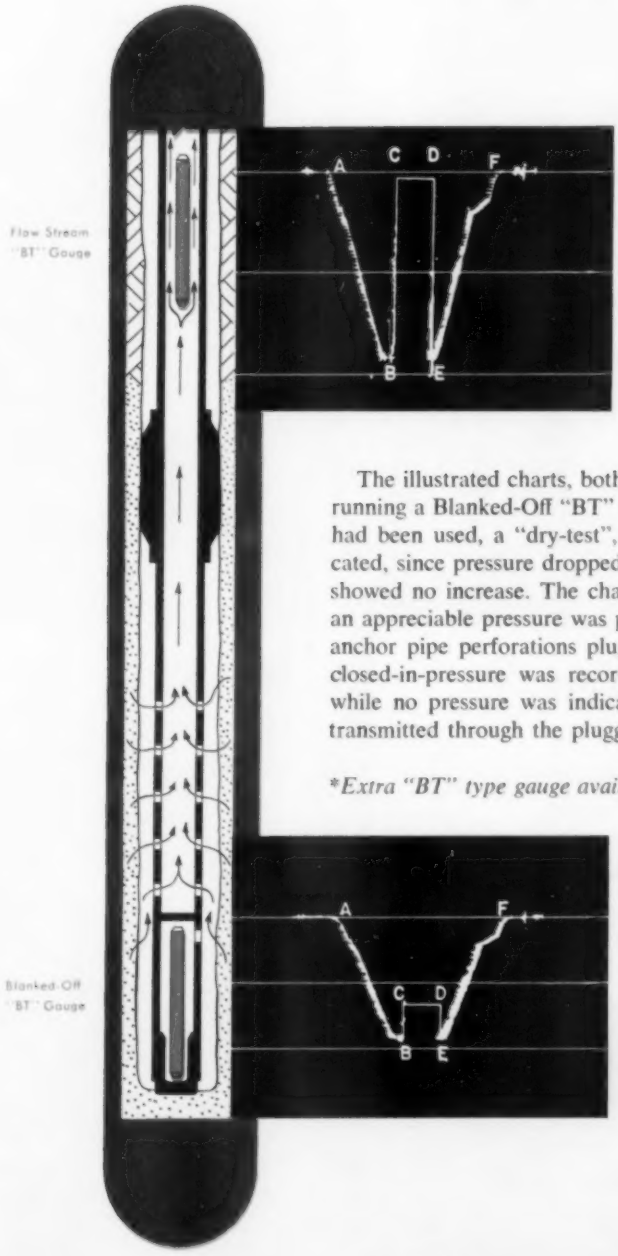
FOR RESULTS! . . . NOT CLAIMS!

USE A HALLIBURTON BLANKED-OFF GAUGE

in your testing string



A Blanked-Off Gauge placed in a formation testing string will result in a more reliable recording of subsurface pressures.

The blanked-off gauge is isolated from fluid passage through testing string so that it records pressure in annulus below packer (see illustration).

The basic benefit derived from using a Blanked-Off Gauge on a formation test is that it reduces the possibility of passing up a productive formation which might otherwise be indicated as dry when plugging of perforations or choke occurs.

The illustrated charts, both made on the same formation test, show the results of running a Blanked-Off "BT" Gauge* in the testing string. If only flow stream gauge had been used, a "dry-test", or non-productive formation, would have been indicated, since pressure dropped to practically zero when tester valve was opened and showed no increase. The chart from the Blanked-Off Gauge, however, shows that an appreciable pressure was present in well bore below packer, thus indicating that anchor pipe perforations plugged immediately after valve was opened. Formation closed-in-pressure was recorded throughout the test by the Blanked-Off Gauge, while no pressure was indicated on the flow stream gauge since it could not be transmitted through the plugged perforations.

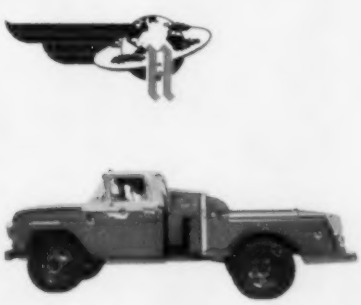
**Extra "BT" type gauge available at slight additional charge.*

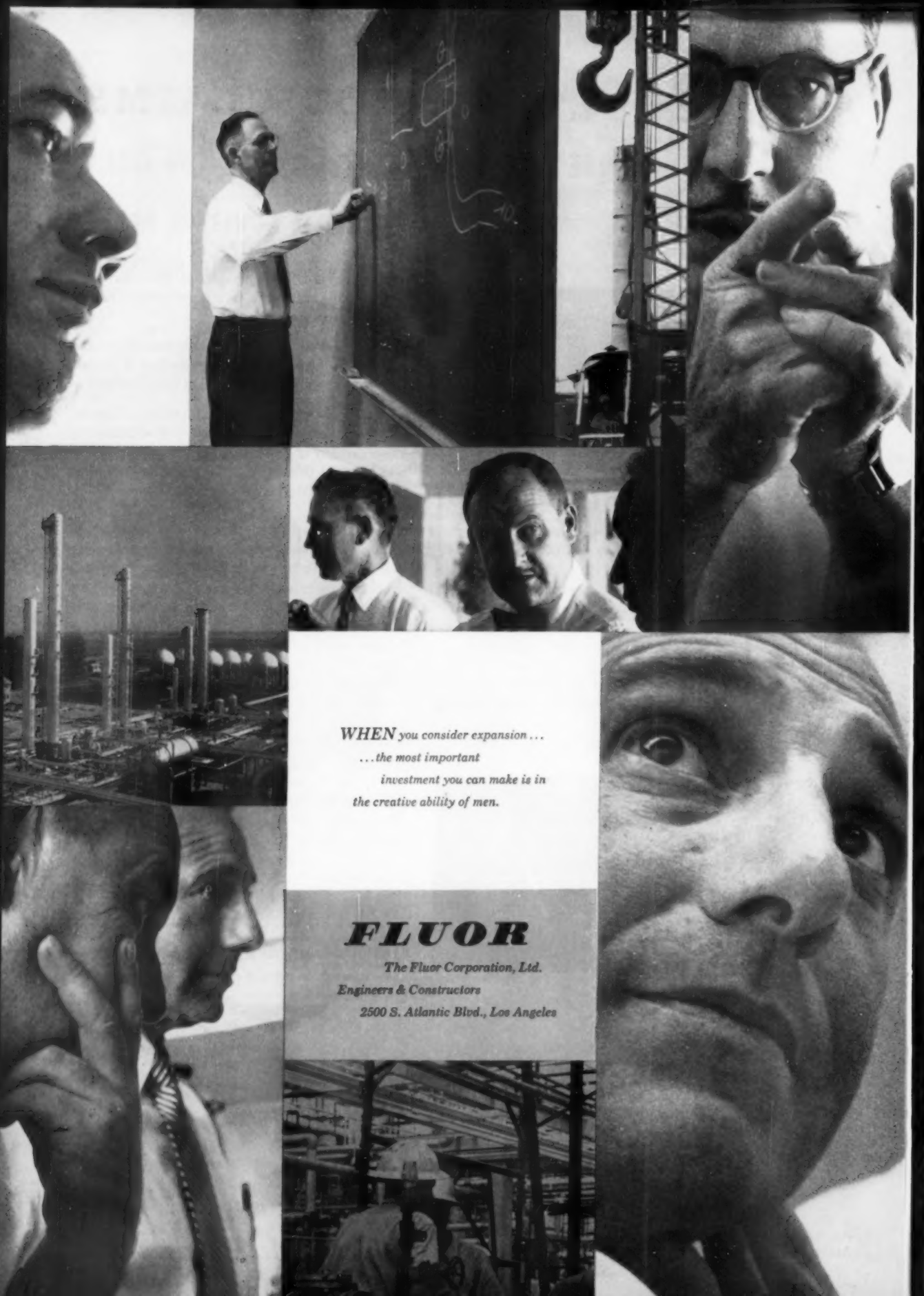
For greater accuracy in formation evaluation... For Testing Results You Can Trust... call for Halliburton Testing Services... every time you program a test.

Line C-D is "Flow Period" and closed-in-pressure period. No indication is recorded of C.I.P. valve being closed as formation was already closed in by plugged perforations. Note the build-up to formation closed-in-pressure on Blanked-off gauge chart instantly after perforations became plugged.

HALLIBURTON

TESTING SERVICES





WHEN you consider expansion . . .
. . . the most important
investment you can make is in
the creative ability of men.

FLUOR

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2500 S. Atlantic Blvd., Los Angeles

pipe can be saw-slotted or gun-perforated. It's expected to be useful as a liner and as a casing window. **Write or call: Wm. E. Sievers Co., 2499 Cerritos Avenue, Long Beach 6, Calif., for details on Omega.**

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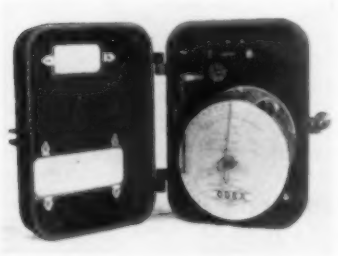


Production-rate recorder

. . . helps operator spot erratic pump flow rates and enables him to isolate causes of erratic production. The instrument gives a complete record of flow rates and pumpoff conditions.

A metal stylus operated by pneumatic impulse marks the time each barrel is produced. Clock-driven wax charts are used. They require no inking. A reset counter keeps a cumulative total of production. The operating mechanism is enclosed in a dusttight case for maintenance-free operation. **Write or call: Odex Engineering Co., 1410 North Grant, Odessa, Tex., for details on production-rate recorder.**

•

Pocket-size radio

. . . for plant personnel permits immediate contact. The transmitter-receiver combination extends two-way mobile-radio systems to the man on foot. He can keep in contact with a system's base station or any of its mobile stations.

The receiver operates from mercury cells or nickel-cadmium batteries. It weighs only 10½ to 12 oz. and is less than 6 in. long, 2½ in. wide, and 1⅛ in. deep. It is crystal-controlled and available for operation in either the 25-54 or 144-174 mc. frequency band.

The transmitter weighs only 46 oz. and measures about 8 by 4 by 1½ in. It provides 1¼-watt output in the 25-54 mc. band and 1.0 watt in the 144-174 mc. band. It puts out 100 milliwatts of audio power to a built-in speaker, providing clear, crisp voice messagers, adequate for most applications.

Both the receiver and the transmitter can be easily carried on a person's belt. **Write or call: Motorola, Inc., 4501 West Augusta Boulevard, Chicago 51, for details on "Handi-Talkie" radio.**

New electric-log slide rule

. . . gives quantitative analysis of electric logs quickly and easily. The handy slide rule provides for automatic correction of all data, and instantly solves all equations in the analysis of any of the various types of logs. It solves both quantitative and empirical relations in deriving porosity and per cent of water saturation.

The rule meets the needs of both the beginner and the advanced log specialist as generalized quantitative relationships and specialized equations having variable coefficients and exponents are provided.

Measuring 5 by 10 in., the rule is

GET TO THE HEART OF YOUR BUILDING PROBLEMS

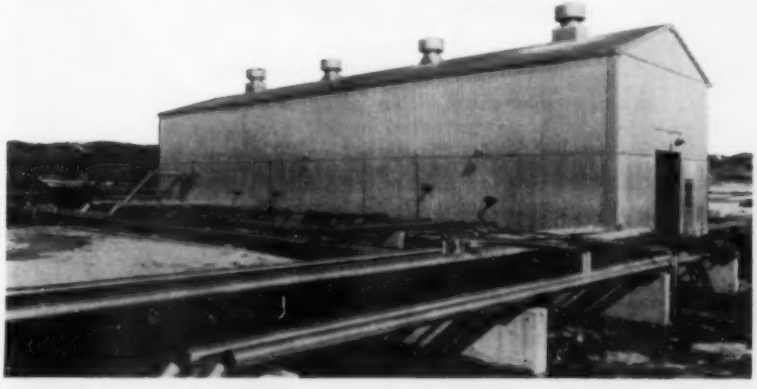
Need Special Covering?

Braden custom engineered buildings can be covered with:

1. Galvanized corrugated steel.
2. Corrugated cement asbestos.
3. Corrugated aluminum.
4. Corrugated aluminized steel.
5. Corrugated protected metal.

Braden design and accurate prefabricated shop construction assure rigidity, weather-tightness and good appearance.

This Braden Building, in the far North, is built from prefabricated corrugated aluminum panels, to withstand sulphuric acid conditions. It is one of some 30 Braden buildings erected at this processing plant. Each engineered to meet extremes of temperatures, wind and roof loads.



Write for Braden Catalog.

BRADEN STEEL CORP.

1007 EAST ADMIRAL TULSA 1, OKLAHOMA

ENGINEERS • FABRICATORS • ERECTORS

formed of vinyl plastic and reinforced with nickel eyelets. **Write or call: Hamilton Well Log Consultants, P. O. Box 7293, Tulsa, for details on electric log slide rule.**

•

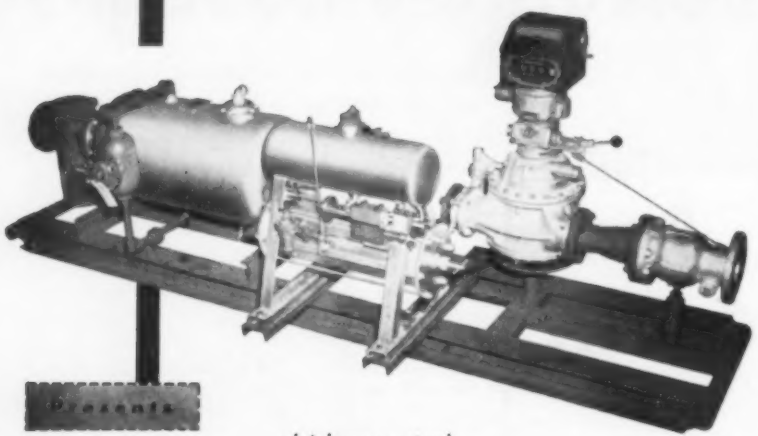
Microwave package for offshore use

. . . on drilling or pumping platforms is designed to extend the life and reliability of communication systems in areas where environment is extremely adverse.

The "weather-enclosed" microwave package includes an air-conditioned housing with zinc-coated steel panels sealed with Neoprene. The housing is prestressed and rigidly constructed to stand high wind velocities. Yet it is light enough to be airlifted intact for transfer from one communications site to another.

The housing is enough to enclose a 25-channel terminal or an 8-channel repeater microwave station to perform telemetering, supervisory channel, telephone, and teletype functions. **Write or call: Section P, General Electric Communication Products Department, Syracuse, N. Y., for details on "weather-enclosed" microwave package.**

MECO Integrated SERVICE



skid-mounted
AUTOMATIC CRUDE OIL

. . . with proportional sampler

Unit automatically shuts down after allowable has been flowed, with volume corrected to 60°F and registered on counter and/or ticket.

MECO sampler stores sample at line pressure.

Air and non-condensible gases are automatically separated from liquid and vented. Metering of gases is prevented.

Unit includes line-size strainer • SMITH line-size deaerator • float-operated pilot and safety shut-down valve • MECO proportional sampler • A. O. Smith positive displacement liquid meter • SMITH set stop valve.

MECO
MAINTENANCE Mechanical CORPORATION
SUBSIDIARY OF
MAINTENANCE ENGINEERING CORPORATION
P. O. BOX 2637 3711 CLINTON DRIVE
PHONE CA 2-2351 HOUSTON 20, TEXAS

Four seals assure tight shutoff

. . . In this gate valve. The new Greenwood multiple-seal gate valve is suited for aromatics, hydrocarbons, and LPG.

The four seals comprise two precision metal-to-metal seats of two secondary O-ring seals.

The valve is a rising-stem type. Gear operators are available. The valve is made of cast steel. Trim is stainless steel. All face-to-face dimensions, wall thicknesses, and flange dimensions conform to A.S.A. specifications. **Write or call: Vernon Tool Co., Ltd., 1101 Meridian Avenue, Alhambra, Calif., for details on multipleseal gate valve.**

•

Separator has high efficiency

. . . in removing entrainment from steam, air, and other gases. The line-supported Type T separator uses centrifugal force to remove entrained moisture and oil. Steam or gas is directed through an annular passage to increase its velocity and produce a strong centrifugal force. The entrained matter strikes the outer wall, drains to the bottom of the separator, and then to an automatic trap.

The separator is available in sizes through 3 in. with threaded connections. With 125-lb. ASA flanges, it's available in sizes through 8 in. **Write or call: Wright-Austin Co., 3245 Wight Street, Detroit 7, for details on Type T separator.**

SHOWCASE . . .

New Literature

LACT equipment data

. . . in a new 50-page technical folder, aids in evaluating and planning lease automatic custody transfer installations. The folder includes schematic drawings of complete LACT metering units. Various inserted bulletins describe positive-displacement meters, strainers, and automatic-control valves. Automatic temperature compensator with full-range gravity selector, strainers, air eliminators, and other specialized equipment are also included. **Write or call: Ralph N. Brodie, Co., Alvarado and 137th Avenue, San Leandro, Calif., for Brodie Technical Data Folder.**

Multithermocouple assemblies

. . . are described in new engineering data Bulletin EDS-47. The assemblies are custom built for individual use. They are used to obtain temperature readings at various levels in deep vessels, reactors, catalyst beds, furnaces, etc. Details and application advantages are given on the use of ceramic-insulated, metal-sheathed thermocouples. A typical assembly, illustrated in the bulletin, is 66 ft. long. The bulletin also contains: (1) details on various standard types of construction. (2) information and specifications on components included in such a thermocouple assembly—thermocouples, extension wire, thermowells, mounting attachments, connection heads, and fittings, and (3) a data sheet for recording of specifications needed for a particular use. **Write or call: Thermo Electric Co., Inc., Saddle Brook, N. J. for Bulletin EDS-47.**

Digital computer control and data-logging

. . . is reviewed in a new four-page brochure. Included is a description of the RW-300 computer as well as discussions of process-control, data-logging, pilot-plant, and test-facility uses for computer-control systems. Specifications are listed for the transistorized RW-300. The computer can handle up to 1,024 analog inputs and up to 128 analog outputs. It can also operate with a wide range of digital input and output equipment, including automatic typewriters, paper tape, and punched card readers, paper type and card punches, and on-off devices. **Write or call: Thompson-Ramo-Wooldridge Products Co., P. O. Box**

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An entire
NEW
Plant devoted
exclusively to the
making of
Precision
BALLS
. . . the best—Strom combines 40 years' experience with the most modern methods and machinery to produce the world's finest balls.
Balls of Chrome, Commercial-type Carbon and Stainless Steels, Brass, Bronze, Monel Metal, and Special Materials
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Largest Independent and Exclusive Metal Ball Manufacturer
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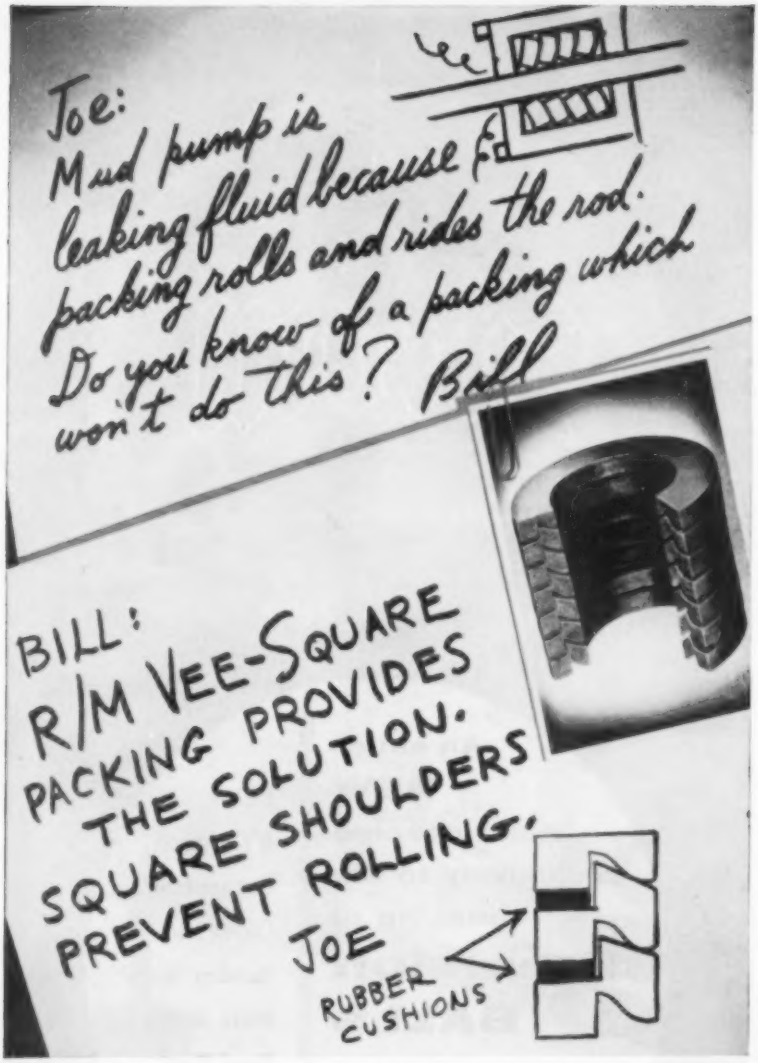
Pacific Coast Representative: R. J. SCHENK, 716 South Main Street, Santa Ana, California
Southwestern Representative: E. E. GRAHAM & Co., 3701 Navigation Blvd., Houston 3, Texas
Chicago Representative: ROBERT YOUMANS, 6110 West 26th Street, Chicago 50, Illinois
8548


Joe:
Mud pump is leaking fluid because packing rolls and rides the rod. Do you know of a packing which won't do this? Bill
BILL:
R/M VEE-SQUARE PACKING PROVIDES THE SOLUTION. SQUARE SHOULDERS PREVENT ROLLING.
JOE
RUBBER CUSHIONS

A triumph of packing ingenuity, patented R/M Vee-Square Packings are designed to come through the roughest treatment with flying colors. They are nonyielding, they require no sensitive gland adjustments, and they can take normal gland pressure. Soft rubber cushion between rings helps prevent blow-by, and they seal automatically.

For reciprocating pumps, oil field mud pumps, high-pressure lubricators, steam hammers and special hydraulic equipment, the solution to your packing problem and your best way of keeping new rods new longer, is R/M Vee-Square Packings.

Call on the vast packing experience of R/M engineers for help in meeting the most exacting requirements of the petroleum industry.

R/M MAKES A COMPLETE LINE OF MECHANICAL PACKINGS—including Vee-Flex,* Vee-Square, Universal Plastic, and "versi-pak"*; GASKET MATERIALS; TEFLON* PRODUCTS. SEE YOUR R/M DISTRIBUTOR.

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R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings Brake Blocks • Clutch Facings • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

45067, Airport Station, Los Angeles 45, for computer and data-logging bulletin.

Pipeline welding fittings

. . . and flanges catalog (48 pages) includes dimensional data on full-encirclement saddles, anchor forgings, gas distribution fittings, 125-lb. taper-face flanges, and 900-lb. welding neck, slip-on, and blind flanges. Allowable working pressures are given for gas distribution fittings. Special pipeline fittings such as 3R elbows, venturi reducers, pig-diverter laterals, scraper-bar tees, and manifold fittings are also listed. **Write or call: Tube Turns, Div. of Chemetron Corp., Louisville 1, Ky., for Bulletin TT 638R.**

Recommended safety habits

. . . to be carried out by rig personnel in air drilling are outlined in new four-page Bulletin 102. It points out that proper training will reduce existing hazards. Most accidents in this type drilling can be traced to carelessness and little importance given to safety planning. The brochure separates operations into four parts for discussion. They are: (1) compressor location and accessory equipment; (2) rig location and equipment; (3) prior to drilling; and (4) drilling operations. **Write or call: Well Completions, Inc., P. O. Box 578, Aurora Station, Denver 8, for Safety Bulletin 102.**

Teflon-lined pipe

. . . that's chemically inert and corrosionproof is detailed in new four-page Bulletin T-S-1A. The Fluoroflex-T Type S pipe and fittings assure a dynamically balanced rate of thermal expansion-contraction between the housing and liner, the supplier reports. Thus, they are freed of thermal shock and fatigue stress. Complete corrosion-resistant piping systems which include tees, short-radius ells, and reducing flanges are detailed as to size, flange diameter, thickness, and mounting dimensions. **Write or call: Resistoflex Corp., Woodland Avenue, Roseland, N. J., for Bulletin T-S-1A.**

New photo-drawing technique

. . . is detailed in a four-page bulletin called Photoneering. The new process combines photography and drawing. Specifications can be drawn directly on a photo taken from any angle or point of perspective. A special heat and humidity-resistant plastic film sheet is used which permits necessary changes or erasures. The brochure explains how photography and drawing

AT LAST . . .

A COMPLETELY RELIABLE

all ELECTRIC

VALVE POSITIONER

NORWOOD CONTROLS

ON DISPLAY AT BOOTH 974-1071 I.S.A. SHOW

- TRANSISTORIZED
- SELF-LUBRICATING
- EXPLOSION-PROOF
- EASILY ADJUSTABLE
- MANUALLY OPERABLE
- LOW STAND-BY POWER
- UNIQUE BRAKING... prevents valve oscillation

Norwood's new all-electric positioner completely eliminates the need for auxiliary hydraulic or pneumatic valve actuating systems and operates from most standard electric controllers. A 1/40 h.p., 2-phase, induction-type electric motor drives the actuating shaft through a highly efficient self-lubricating gear train and ball-screw mechanism.

Stroke can easily be field-adjusted from ½" to 2". Shaft speed is .15 in./sec. Maximum thrust is 1000 lbs. and built-in limit switches prevent valve damage.

Shaft oscillation is effectively prevented by means of a unique, electro-mechanical braking system which prevents movement of the shaft unless the motor is energized or unless it is being operated manually. The combination of an anticipatory circuit with dynamic braking narrows the dead band and ensures repeatability of position to within ¼%. Stand-by power requirement is as low as 50 watts.

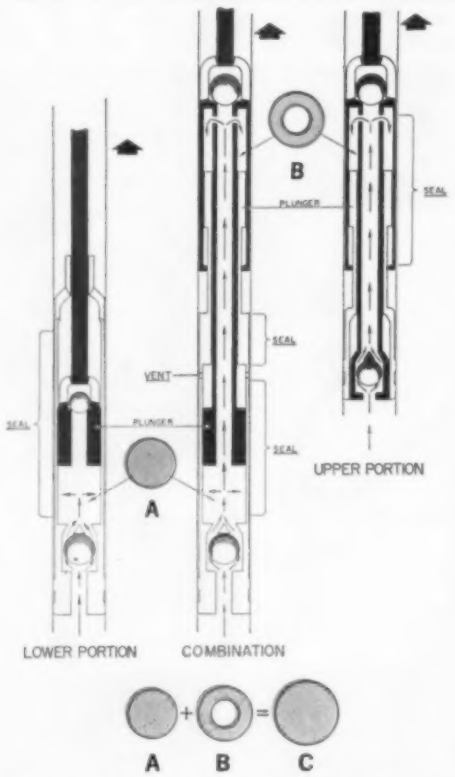
For further information, write for data sheet B158-5.

Norwood Controls Unit, Detroit Controls Division, 942 Washington St., Norwood, Mass.

AMERICAN-Standard

DETROIT CONTROLS DIVISION

NEW AXELSON VOLUMAX INCREASES PRODUCTION FLOW



Shaded circles indicate volume areas. Plunger area (A) plus annular area (B) result in increased production area (C).

Axelson's new Volumax pumps will outperform any similar pump currently available for 2" tubing.

Special ⅞" liner column uses ⅞" plunger to effectively seal and create an upper telescoping annulus. Resulting production is 22% more than that obtained with a tubing pump.

Lower portion plunger area (A), plus upper portion annulus area (B), combine to provide increased volume (C).

ALL VOLUMAX PUMPS PROVIDE THESE ADVANTAGES:

1. Volumax pumps may be operated at a depth limited only by sucker rod stress.
2. Tandem pump construction provides extreme rigidity of all parts during compression portion of stroke (downstroke).
3. Maximum fluid passage — minimum drag.
4. Optimum plunger fits established through practical field experience.
5. Exceptionally good hold-down ability.
6. An insert pump, tubing need not be pulled.

Write today for the new Volumax brochure

AXELSON

There is no economical substitute for quality

AXELSON MANUFACTURING COMPANY

Division of U. S. Industries, Inc.
6160 So. Boyle Avenue, Los Angeles 58, Calif.

Since 1898
products designed to give oil a lift

AXELSON PRODUCTS ARE DISTRIBUTED EVERYWHERE

CALIFORNIA: Axelson Sales and Service Stores in all principal California fields
Hickey Pipe and Supply Co., (sucker rods), Los Angeles, Coalinga

MID-CONTINENT AND EASTERN: Jones and Laughlin Steel Corp., Supply Division, Tulsa

ROCKY MOUNTAIN: Jones and Laughlin Steel Corp., Supply Division, Tulsa
Great Northern Tool and Supply Co., Billings

CANADA: Jones and Laughlin Steel Sales Co., Ltd., Supply Division, Calgary
Dominion Oil Fields Supply Co., Ltd., Calgary

FOREIGN: Represented in all major oil-producing areas.

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combine to save time and money and make engineering drawings easy to visualize with minimum interpretation. **Write or call: Technical Reproduction Service, 375 South Street, Newark 5, N. J., for Photoneering Bulletin.**

Resistivity-log brochure

. . . which outlines work done with the Guyod Analog Computer for six major oil companies, is now available in a 20-page form. More than 7,000 resistivity curves are described. These were recorded with normals, laterals, the Limestone device, a guard-electrode, and various laterologs. These curves supply basic data never before made available for the interpretation of electric logs. **Write or call: Hubert Guyod, P. O. Box 282, Bellaire, Tex., for Resistivity Log Brochure.**

Digital indicating instruments

. . . based on servo null-balance principle are discussed in new Bulletin 1758 now available. The bulletin describes common types of transducer pickups used with this type indicator and points out numerous uses. Illustrations include measurement of compression, tension, torque, pressure, flow, and temperature. **Write or call: Performance Measurements Co., 15301 West McNichols, Detroit, for Bulletin 1758.**

Physical, chemical properties

. . . of mono, di, tri, and tetraethylene glycol are discussed in a new 40-page technical manual. It gives specifications and analytical techniques required for determining product quality. It includes an extensive indexed bibliography. Characterized by their water solubility, hygroscopicity, moderate viscosity, and freezing-point depression on water, the glycols find applications in the dehydration of natural gas. **Write or call: Jefferson Chemical Co., Inc., 1121 Walker Avenue, Houston 2, for glycol technical manual.**

Service regulators

. . . are covered in new 20-page Bulletin 1026, Rev. 3, now available upon request. The two-color, photo-illustrated bulletin describes for the first time all three Rockwell regulators the 107, 143, and 173— designed and built for domestic gas service. Other bulletin features include cross-sectional views of the regulators and outlet-pressure adjustment range, capacity, and dimension tables. All statistical information has been brought up to date. **Write or call: Meter & Valve Div., Rockwell Mfg. Co., 400 North Lexington Avenue, Pittsburgh 8, for Bulletin 1026, Rev. 3.**

Metering and separation equipment

. . . is now described in eight-page Condensed General Catalog 58G. It gives detailed information on a line of oil meters, standard and high-capacity metering separators, automatic custody transfer units, calcium chloride gas dehydrators, and other products. **Write or call: Rolo Mfg. Co., P.O. Box 22126, Houston 27, for Catalog 58G.**

Blowout-preventer catalog

. . . is now available for the asking. The 20-page publication is complete with illustrations, photos, diagrams, charts, and equations. It contains information on a blowout-preventer operating unit. Charts specify correct size units for various sizes and types of blowout-preventers. Specifications for fluid manifolds, power source, remote controls, and other data also are provided along with formulas and examples for selecting proper operating units. **Write or call: Stewart & Stevenson Distributing Co., P.O. Box 1637, Houston, for Blowout-Preventer Catalog.**

GALVOMAG ANODES USED TO PROTECT 300-MILE LINE

This pipe line company had an old, bare, 8-inch product line that ran 300 miles across three states. The increasing number of corrosion leaks made it imperative to take corrective measures. CSI was awarded a cathodic protection contract on a competitive bid basis.

CSI engineers made soil resistivity tests, determined the size of anodes to use, and staked the anode locations. Then CSI's experienced crews installed 2300 Galvomags, the high-potential magnesium anodes developed by The Dow Chemical Company. CSI also furnished all other necessary materials and equipment, including augers and ditchers.

The job was done to the complete satisfaction of the pipe line inspectors.

You, too, will find it pays to call our stockholder employees— for engineering consultation, installation services, and quality cathodic protection supplies. Estimates or quotations without obligation. Call or write today.

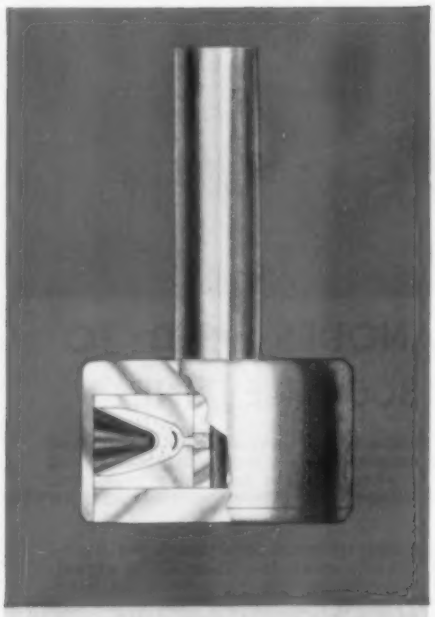
CSI

CORROSION SERVICES INCORPORATED

Cleveland 13, Ohio
1309 Washington Ave.
Tel. CHerry 1-7795

General Office: Tulsa, Okla.
Box 7343, Dept. J-20
Tel. Circle 5-1351

Welex EIGHT-WAY Frac-Jet*
Places the Wedge



Any lumberman will tell you that the way the wedge is placed determines the way a log is split along the grain of the wood—faulty placement and what should have been top-grade lumber turns out to be fire wood.

Any oilman will concur that for a successful fracture job, the placement of the fracture determines the end result after the well is treated.

Welex 8-Way Frac-Jet gives you just the start you need to control fracturing along the bedding plane of the rock. Actual tests by a major oil company proved this when horizontal fracturing was obtained in two separate zones in four wells 50 feet apart, each equidistance from an injection well in the center. Two shots with the Welex Frac-Jet and subsequent fracture treatment provided fractures from the center well to all four test wells—50 feet apart—with less than 2 feet variance in either plane *completely around* the injection well.

For actual controlled fracture placement—proved by a major oil company—let the Welex Frac-Jet give you the break you need.

ORIGINATORS OF Welex JET PERFORATING

WELEX, INC.

Fort Worth, Texas

Division offices in Denver, Houston La Habra, Midland, New Orleans, Tulsa and Wichita • Subsidiaries in Canada, Peru and Venezuela

*Trademark of Jet Research Center, Inc.

EQUIPMENT MEN

Oil Well Supply Div. shifts

. . . two district managers, according to M. F. Jones, Gulf Coast area manager of the division of United States Steel Corp. B. A. August, previously district manager at San Antonio, Tex., transfers to New Orleans, La. H. W. Solsbery, formerly manager of the New Orleans district, becomes manager of the San Antonio district. August joined Oil well in 1937 and Solsbery in 1948.

Continental-Emsco Co. sets up

R. E. Scheibel

. . . an industrial sales department responsible for direct and dealer sales of Continental-Emsco's swivel joints and other industrial products. The new department is headed by R. E. Scheibel, formerly a division merchandise manager. He will headquarter in Dallas, Tex. The new department is under the supervision of W. C. Kinder, vice president.

New plant started in Amsterdam

. . . for making platinum reforming catalyst for the oil industry. Built and managed by Ketjen, the plant is the first enterprise of Cyanamid-Ketjen N. V., a new subsidiary of American Cyanamid Co. The manufacture of ultraforming catalyst is done under a license of Standard Oil Co. (Ind.). The plant will also serve the existing powerforming units and ultraformers licensed by Standard Oil (Ind.) outside the Western Hemisphere.

Clark Bros. Co. signs manufacturing agreement

. . . with Armstrong Siddeley Motors Ltd. of England. It provides for British manufacture of Clark-designed gas turbines for use in the oil, gas, chemical, and process industries in many areas of the world. Attending the signing ceremony in Paris are: F. T. Blakey, secretary of A.S.M.; H. T. Chapman C.B.E., managing director of A.S.M.; A. Thomas M.B.E., deputy chief engineer and chief designer of A.S.M.; R. R. McCartney, vice president in charge of overseas operations of Clark Bros.; R. Chesneaux, president of Societe Francaise des Industries Dresser S. A.; and M. J. Galpin, manager of Clark Bros., England.

Jim Sayers appointed

Jim Sayers

. . . as manager of Canadian operations for H. C. Smith Oil Tool Co., according to A. S. Marshall, vice president, sales. Sayers will headquarter in Edmonton, Alta. For the past several years, he was with Security Engineering Division, Dresser Industries, Inc.

Drilling contractors commend Hughes Tool Co.

. . . for its nearly 50 years of research devoted to the advancement of rotary drilling. The commendation is contained in a resolution passed by the American Association of Oilwell Drilling Contractors and presented in a plaque to executives of the company in Houston. The presentation was made by J. U. Teague, president of AAODC, to M. E. Montrose, vice president, sales, and Dr. Daniel J. Martin, vice president, engineering, for Hughes. Montrose praised the drilling industry for its close cooperation in supplying data from more than a half million bit runs annually. He pointed out that the tabulation of this information gives drilling contractors an accurate picture of the performance of various types of bits under all possible drilling conditions.

Sauder Tank Co., Inc., adds

. . . the following to its sales staff. K. S. Dannenfelser becomes manager for the newly-opened branch office at Pratt, Kans. J. E. Brehm is sales engineer working out of Wichita. T. R. Dome, currently serving as a staff engineer in Baton Rouge, La., now assumes the responsibilities of sales engineer out of the home office in Emporia, Kans.

New representatives named

. . . according to Sam Horwitz, president of Mid-Continent Tube Service, Inc., and Midco Valves & Fittings, Inc., Evansville, Ill. C. V. Zanin and Raymond Diadul were named Chicago area sales and service representatives. Fred J. Reynolds Co., Davenport, Iowa, was appointed representative for Iowa, Nebraska, and the quad-cities area. Brookes Engineering, Denver, Colo., will handle sales

and service for Midcotube and Midcovalve in Colorado, northern New Mexico, and Wyoming.

Austin E. Olson named

. . . microwave district sales manager on the East Coast for Motorola Communications & Electronics, Inc., a subsidiary of Motorola, Inc. He succeeds Raymond Kendall. Olson will be in charge of the 15-state area extending from Maine to South Carolina. He has been with the company for 8 years.

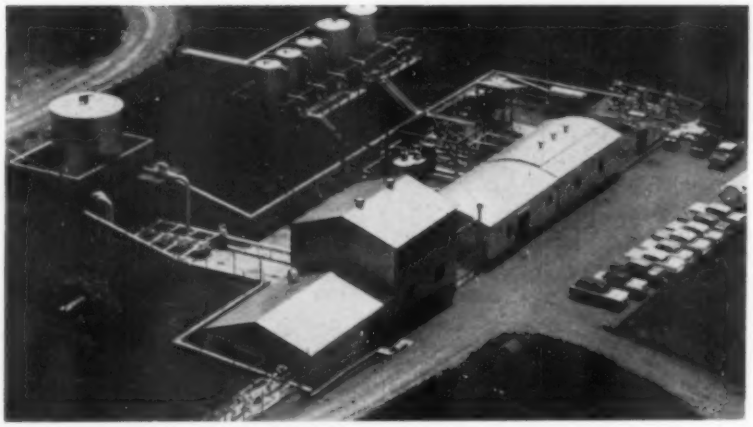
R. N. Maples appointed

R. N. Maples

. . . manager, traffic department for Jones & Laughlin Supply Division, succeeding C. J. Jernigan, who has retired, according to L. G. Sutter, general manager, administrative services. Maples had been with Southwestern Freight Bureau in St. Louis, from 1934 until 1958.

Crouse-Hinds Co. purchases

. . . 50% of the stock of Domex S. A. de C. V., according to R. J. Sloan, president of Crouse-Hinds, and A. A. de Dominicis, president of Domex. Officers of Domex will be Dominicis, president; Sloan, vice president; R. W. Cummings, treasurer; and G. Clamont, secretary. They also form the board of directors. Domex has been appointed national distributor in Mexico for all Crouse-Hinds conduit fittings not manufactured in the Republic.



Rockwell Manufacturing Co. opens new facility

. . . at Murraysville, Pa., with equipment to test petroleum meters up to 10,000 g.p.m. The equipment has been installed at Rockwell's meter and valve testing station expressly to provide testing equipment for units capable of metering more than 2,000 g.p.m. Heretofore no facilities were available to check such large meters equivalent to field testing under actual operating conditions.

A unit for testing gas equipment, such as large regulators and meters, has also been set up. It consists of a high pressure compressor and an underground storage system of 12-in. welded pipe. The compressor can deliver 1,500 lb. at flows of more than 1,000,000 cu. ft. an hour.

Jack E. Clements joins

. . . the sales force of Drilling Fluids Corp., Houston. His association with the oil business encompasses almost 24 years. He was previously with Wilson Supply Co. for 10 years. He joined Drilling Fluids directly from 13½ years of service with Gulf Oil Corp.

J. H. Coman appointed

J. H. Coman

. . . as vice president of W. C. Norris, Manufacturer, a division of Dover Corp., reports Wm. L. Butler, president. In his new position, Coman will direct the operations of the material control, warehouse, and shipping departments. He will also be responsible for the recently organized machine tabulating department. He has been with the company since 1936.

Western Co. holds fall sales meeting in Midland, Tex.

. . . with 39 district managers, sales supervisors, and sales engineers attending. These personnel are from the Hobbs, N. M.; Odessa, Snyder, Seagraves, Rankin, Kermit, Andrews, Midland, and Fort Worth, Tex., offices of the company. The all-day program emphasized sales supervision and organization matters and new developments of products and equipment of the company.

Macco Oil Tool Co. appoints

. . . L. A. Christopher Co. as representative in the Rocky Mountain area for sales, service, and design of Macco gas lift installations. The new representative maintains offices in Denver and Durango, Colo.

Genesys Corp. names

. . . Edward L. Braun director of systems and electronics; and J. B. Rawlings controller. Prior to his present position, Braun was with Northrop Aircraft, Litton Industries, and Librascope, Inc. Rawlings was formerly with American Pipe & Construction Co.

Strohmaier, Lindeman named

. . . as general manager and general sales manager, respectively, of Penberthy Manufacturing Co., a division of Buffalo-Eclipse Corp. Both men

H. E. Strohmaier

A. N. Lindeman

have been with Penberthy for more than 20 years. Howard E. Strohmaier was general sales manager before he was promoted to this new position. Arnold N. Lindeman previously held the position of chief engineer.

Alco Products, Inc., names

. . . Art Makris a sales engineer, specializing in heat exchanger sales, and M. R. Lovering a sales engineer in heat exchanger repair and rebuilding. Also named is W. L. Henderson as sales engineer in Lafayette, La., specializing in oil-field products. C. P. Gillespie transfers as a sales representative from Lafayette to Houma, La. Makris joined Alco in 1957 at Houston. He formerly served with Eastern States Petroleum Co., Houston.

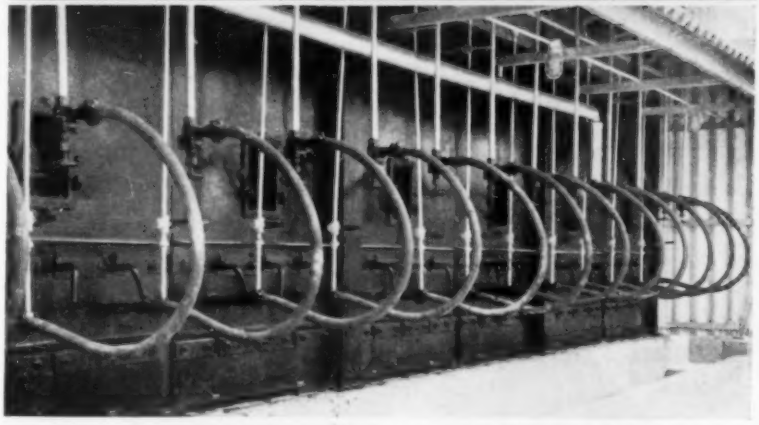
F. H. Maloney Co. establishes

. . . a new district in the Chicago area. This district will be headed by sales engineer, Bob Churnside. He was in the Houston office. Joseph V. Kidd has joined the company as a sales engineer in the Houston area. He was formerly with Champlin Oil & Refining Co.

E. G. Schempf goes to Spain

. . . for conferences with executives of Comision Investigaciones Petroliferos Valledro, petroleum firm backed by Spanish and American capital. Schempf is president of Precision Exploration Consultants, Ltd., Tulsa. He was joined in Paris by N. J. Christie, president of Exploration Consultants, Inc., an affiliate organization. These two executives also represent newly-

NATIONAL AIROIL AIROCOOL MULTIPORT GAS BURNERS *for* CENTER WALL UP-DRAFT HEATERS



. . . were especially designed and developed for angled firing vertically in all types of radiating wall furnaces-heaters . . . They are not an improvization.

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- **Nozzles that can be machined to direct the flame impact at 15°, or any other desired angle to produce the highest degree of heat transfer by radiation from the incandescent reflecting wall. They produce a short flame.**
- **An accurate secondary air adjustment to allow close limits of any excess air and thus result in the highest fuel efficiency.**
- **Higher B.T.U. capacity and greater turn down ratio, with only scant furnace draft and with a minimum of secondary air.**
- **Unique design features that enables them to burn high Hydrogen gas without "flash back".**
- **A reduced size and weight of refractory burner block of inexpensive design.**
- **Means for easily and quickly withdrawing or inserting the gas burner, and requiring only a minimum of labor to accomplish it.**
- **A low maintenance factor including that of the nozzle which is heat protected on its upper surface.**

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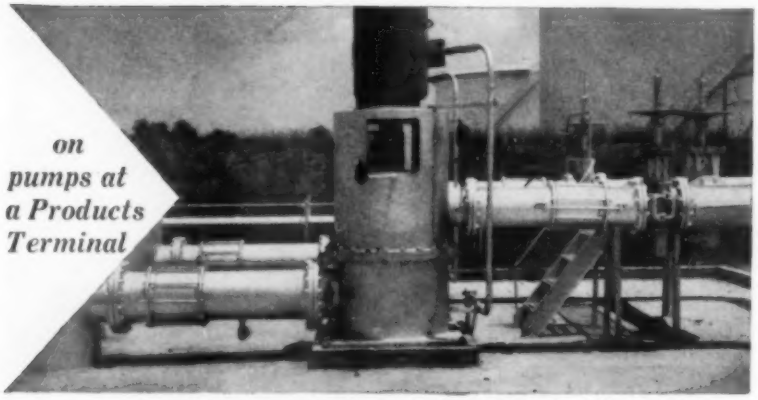

on pumps at a Products Terminal

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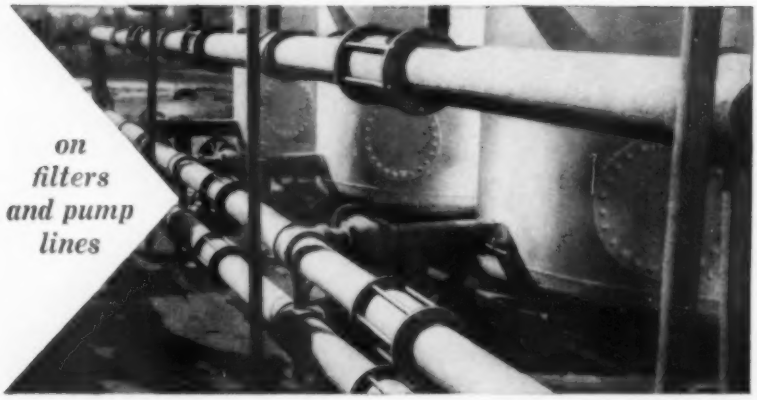

on filters and pump lines

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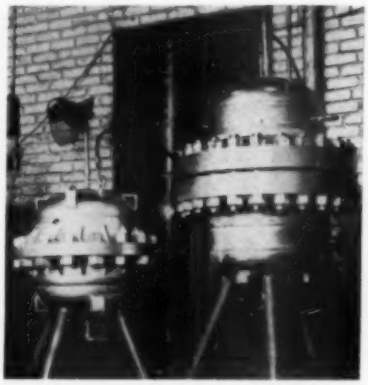
formed Precon, an exploratory firm formed with Consolidated Geophysical Surveys of Tulsa.

Jay C. Failing named

. . . chief sales representative for a new line of rotary earth-drilling equipment designed under his direction and scheduled for production by Mobile Drilling, Inc., Indianapolis, Ind. He was formerly with George E. Failing Supply Co. as exclusive sales representative for the western United States and Mexico.

Appointment, additions made

. . . at Thompson-Ramo-Wooldridge Products Co. J. A. Trapp has been named manager of the data processing and controls department, engineering division, in Los Angeles. He formerly was with North American Aviation, Inc. B. R. Newman, sales engineer, and F. G. Semere, sales engineer, have joined the company. E. C. Swanson, field engineer, also has joined the company. Joining T-R-WP as a sales engineer is G. H. Heilborn.



Charles Wheatley Co. conducts

. . . a flange failure test at it's Caney, Kans., plant to demonstrate the features of "O" ring seals compared to conventional seals. The test was held under the supervision of United States Testing Co., Inc., Tulsa Testing Laboratory, using the two 20-in. flange units shown. Each test unit was brought up to 1,500 psi. and held at this pressure for 5 hours. The pressure was then increased slowly to failure.

As certified by J. B. Davis, United States Testing, the final failure pressures were 2,650 psig. on the flat gasket test unit and 3,000 psig. on the "O" ring test unit. It was also noted that the conventional seal failed with a spray of fluid while the "O" ring dribbled fluid. The test was observed by some 50 engineers, superintendents, and managers from interested oil, gas, and pipeline companies.

Fred C. Koch elected

. . . to the board of directors of Universal Oil Products Co., according to D. W. Harris, board chairman. Koch is chairman of the board of Koch Engineering Co., Inc., Wichita, Kans. He has been with the oil refining industry since 1924.

Donald L. Benscoter named

. . . Dallas district manager for Burroughs Corp.'s ElectroData division, according to E. S. McCollister, marketing director. Benscoter will be in charge of sales and service of Burroughs E101, 205, and 220 electronic computers and data processing systems in the South Central states, from Mississippi to New Mexico. He succeeds J. A. Resca, recently named New York district manager for the division.

Roy W. Johnson joins

. . . Culbert Pipe & Fittings Co. as vice president in charge of sales, reports Edwin W. Thompson, president. Johnson was formerly executive vice president of Republic Supply Co. of California.

Howard M. Thompson appointed

. . . as manager of Warren Automatic Tool Co.'s field application department. In this position he will coordinate the development of new and improved instruments from the research department to their practical application in the oil field. He was formerly with Thompson Drilling Co. and Stanolind Oil & Gas Co.

A. V. Feuerstein, Jr., named

. . . as advertising coordinator of Philco Corp.'s government and industrial division, reports R. M. Fielding, public information manager for the division. In his new capacity, Feuerstein will be responsible for all phases of the division's advertising and sales promotion activities. He reports directly to Fielding.

William DeRuyter appointed

. . . area service representative, European region, for Cummins Diesel Export Corp., a subsidiary of Cummins Engine Co., Inc. He joined Cummins 2 years ago. In his new position he will represent the company in Holland, Belgium, Germany, France, Switzerland, Austria, Italy, Libya, Tunisia, Algeria, and Morocco. He will contact manufacturers using Cummins diesel engines and serve in a sales and service capacity with customers and users.

Tube-Kote, Inc., dedicates

. . . a new research laboratory, according to E. G. Holm, vice president and general manager. The laboratory facilities house Tube-Kote's quality control, production control, the research sections, and the coating evaluation activities. The facilities in the new research laboratory will enable Tube-Kote to test specialized coatings in a high pressure device that simulates actual conditions under the most severe circumstances.

Holland Howell becomes

. . . president of Refinery Construction Co. of Houston. He was formerly chief engineer of Republic Oil Refining Co., Texas City, Tex.

Korody Marine Corp. reports

. . . the completion and delivery of four 66-ft. machine shop barges to the Amazon area for an oil company in South America. These vessels were specially designed by Korody Marine and are to be used as floating bases for the maintenance and repair of oil drilling rigs and oil well pumps. These barges have a 14 ft., 3-in. beam and a shallow draft of only

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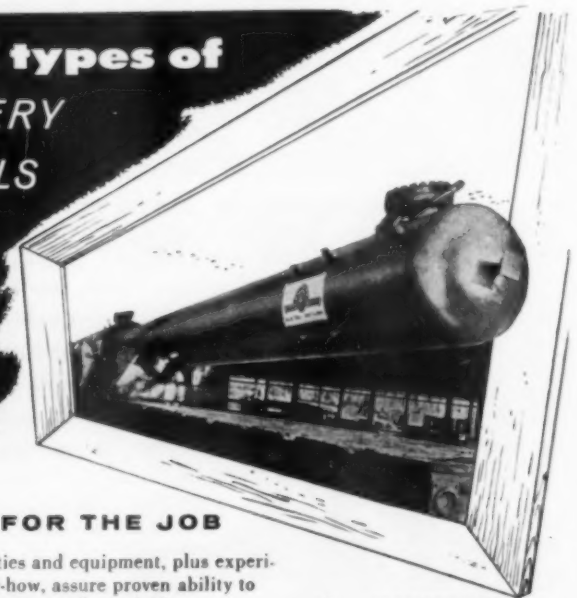

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Master's facilities and equipment, plus experience and know-how, assure proven ability to fabricate pressure vessels to rigid engineering specifications. Write — wire — phone MASTER *FIRST* for the finest in steel fabrication.

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Master also produces API 5LX HI-TEST Expanded Line Pipe

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2 ft. 6 in., with a displacement of approximately 45 tons. Propelled by a General Motors series 4-71 diesel engine, the barge can obtain speed up to 10 miles per hour. The same engine drives a 25-kw. 220-volt generator which provides power for the machinery on board.

W. C. Meeks, Jr., transfers

. . . from Hobbs, N. M., to Denver, Colo., according to John W. Gates, vice president and sales manager of Well Equipment Manufacturing Corp. Meeks is a sales representative and has been with Weco for the past 6 years.

W. A. Penner appointed

W. A. Penner

. . . district office manager of Worthington Corp.'s Denver, Colo., district office, reports A. W. Fraser, general marketing manager. Penner replaces C. R. Walbridge. Penner joined Worthington in 1938. He has served in various engineering and engineering sales capacities in its Washington, D. C., San Francisco, and Los Angeles district offices.

General Controls Co. names

F. E. Weldon

. . . Fred E. Weldon as vice president in charge of eastern sales, according to J. F. Ray, sales vice president. Weldon joined General Controls in 1946. He has been sales manager with headquarters in the Middle West since 1952.

Creole Engineering renamed

T. E. Kraner

. . . C-B Southern, Inc., according to Eugene L. Miller, president of The Cooper-Bessemer Corp. This follows closely the recent acquisition of Creole Engineering Corp. by Cooper-Bessemer. C-B Southern's president, T. E. Kraner, states that its initial engineering and manufacturing will concentrate on completely packaged, prepiped gas engine compressor units of the type marketed by Cooper-Bessemer for gas gathering and similar requirements.

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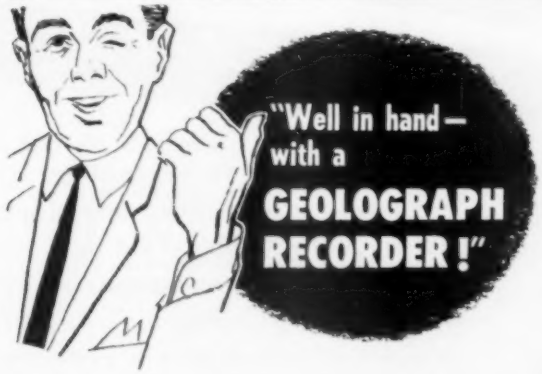

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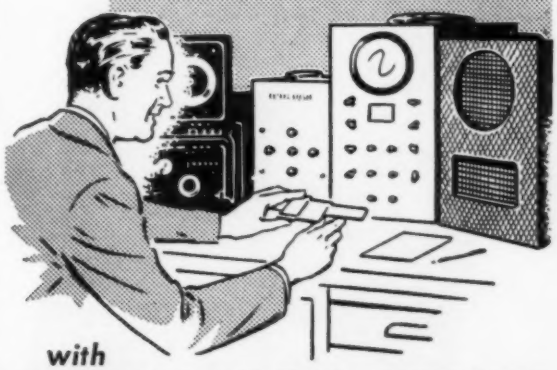

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Rings reach maximum size in the well within a few hours.

Dimensional Compensation during the manufacturing process assures the uniform working fit obtained with Martin Split Rings.

The Martin Ring Size Guide Table* assures proper ring size selection for various gravities, temperatures, and sand and water content.

Martin Split Rings are made in steps of .005" in diameter, so that you can actually increase or decrease plunger clearance that amount by changing to next larger or smaller size.

The gaps between the Martin Rings cause fluid turbulence which slows down slippage past the Martin Plunger — just as a rough road slows down your driving speed. Actually, the Martin Plunger maintains pumping efficiency with a looser fit than is possible with a smooth surface plunger.

* See the complete Martin Catalog and instructions in the 1957 Composite Catalog.

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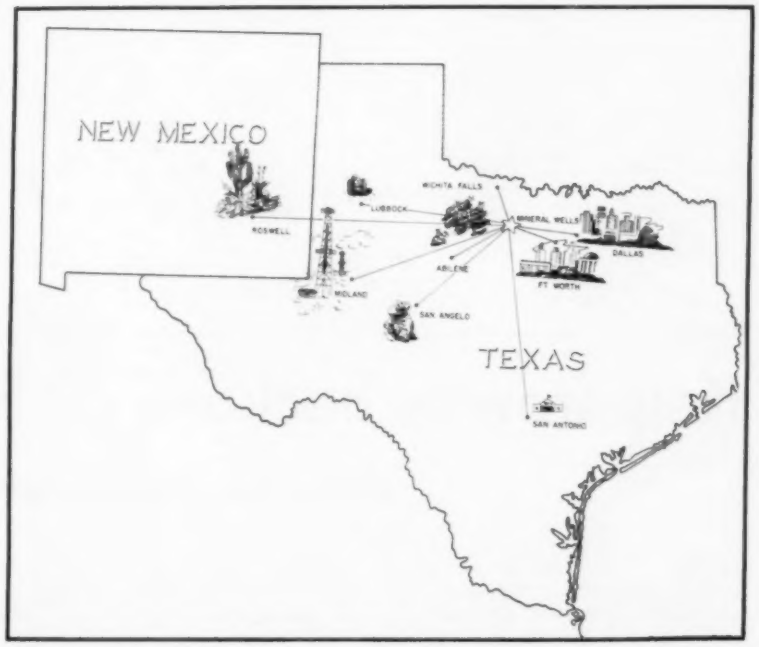
Southwestern oil finders will sound off

. . . at the first meeting of a new outfit

BY FRANK J. GARDNER

NEXT WEEK, a newly born geological organization will hold its first get-together in Mineral Wells, Tex. The Southwestern Federation of Geological Societies was welded together earlier this year as an affiliate of the American Association of Petroleum Geologists. It fills a big gap, for not until now has it been possible to bring together under one roof all its nine groups of geologists for a discussion of mutual problems and interests.

The member societies are those of Dallas, Fort Worth, Wichita Falls, Lubbock, Abilene, San Angelo, Midland, San Antonio, and Roswell. To these oil finders goes much of the credit for the existence of our great Permian basin oil industry today. Now they'll sit down together and try to iron out problems standing in the way of even greater discovery there. Papers listed on the technical program scheduled for October 24 and 25 (OGJ, Oct. 6, pp. 296-297) reflect a broad new look at every geologic province in the southwest.



OIL FINDERS from nine southwestern cities will hit the trail to Mineral Wells, Tex., next week, as the Southwestern Federation of Geological Societies opens the doors to its first technical meeting.

A certain oil potential . . . Especially interesting is the emphasis to be placed on potential oil provinces of the future. We often hear it said today that West Texas has "had it" and that little remains to be found out there. Not so. And these southwestern oil finders know it. They're going to take a look at such areas as the Palo Duro basin, the Fort Worth basin, the Ouachita structural belt, the South Plains, and the Trans-Pecos area. Very little oil has been found in some of these spots. In others, none at all. But Permian basin rockhounds firmly believe that they all possess a certain oil potential.

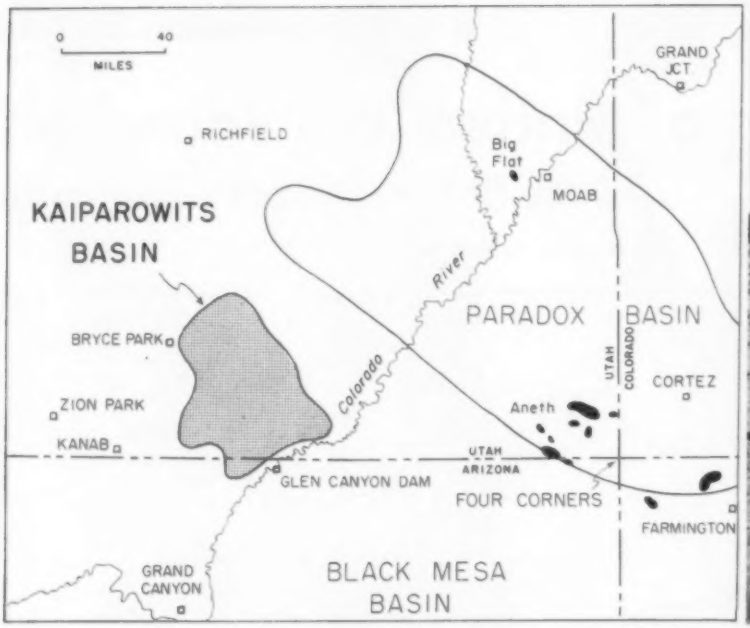
There'll be some geological VIP's there, too. George Buchanan, genial president of AAPG, will address the delegates at a special luncheon on October 23. The keynote speaker is to be Edgar W. Owen, a past president of AAPG and noted geological lecturer at the University of Texas.

At the meeting place . . . One interesting sidelight to this meeting is the attention to be paid to the geology of the meeting site itself — Palo Pinto County. W. N. Tindall, geologist for Mayfair Minerals of Abilene, will first present a paper on the oil and gas possibilities of the county. Then, on Saturday, October 25, the federation will sponsor a field trip covering the county so that delegates may have a first-hand look at it. If this becomes precedent, future meeting sites will certainly have to be selected with care, for a combination of hotel capacity, oil potential, and interesting geology is hard to come by.

May produce new fields . . . A further point of interest lies in the word "possibilities" as applied to Palo Pinto County, an oil and gas producer since 1909. The implication is, of course, that our old oil areas still hide a lot of undiscovered fields. Palo Pinto has attracted a great deal of recent attention from land men because of the richly rewarding hunt for gas in Jack and Wise counties which adjoin it on the north and east (OGJ, Mar. 17, 1958, p. 240). Actually, it has never been adequately explored, and it's entirely possible that this new interest will turn up some fine new fields for Palo Pinto.

The organization of the Southwestern Federation affords yet another regional sounding board for the geologist. The growing importance of the regional meeting in recent years reflects the increased tendency of the oil finder to concentrate on his immediate sphere of operation at the expense of other regions over the fence. From this standpoint of finding oil in his own bailiwick, this may be constructive. But any drift toward provincialism in the nomadic geologist's life should be avoided. This dictates a revival of interest in the various national meets, which have suffered somewhat from the regionals.

This new group, then, has a definite role to play, and its growth and progress will be closely watched. From its activities, West Texas, New Mexico, and the nation should benefit.



Kaiparowits beckons oil hunters

along the canyon-cut Arizona-Utah border

BY EDGAR B. HEYLMUN
Consulting Geologist
Salt Lake City, Utah

LONG A PARADISE for the camera fan, the beautiful and desolate cliff and canyon country of southern Utah and northern Arizona may, in the near future, become a paradise for the oil driller.

The oil and gas developments in the Four Corners area and in the rest of the great Paradox basin are well known; little, however, is known about petroleum possibilities in adjacent regions. One such region is the Kaiparowits basin, which lies to the west of the Paradox basin.

The Kaiparowits basin proper occupies the central part of Kane and Garfield counties, South Utah, and is separated from the Paradox basin by the Circle Cliffs upwarp. It is contiguous with the Black Mesa basin of northeastern Arizona, and the two are quite similar in many respects. They are separated by the deep canyon of the Colorado River. In general parlance, the term "Kaiparowits basin" includes most of the surrounding regions. Since they are closely related to the basin itself, the same practice will be used in this discussion.

Rugged terrain . . . The Kaiparowits basin lies in one of the most rugged and inaccessible parts of the United States, although recently constructed roads have opened up vast new areas. Topographically, the region bears little resemblance to a "basin." The Paria River valley, in the western part of the region, is relatively low with respect to other elevations, but the remainder consists of buttes, mesas, and plateaus with elevations ranging between 4,500 and 7,000 ft.

The high plateaus to the north and west have elevations in excess of 10,000 ft. and collect heavy snows in the winter. Most of the lower elevations, however, are very dry and have mild winters. The Colorado River and its tributaries drain the entire region, and in the vicinity of the river the terrain is deeply eroded and largely inaccessible.

The Glen Canyon dam is being built on the Colorado River near the Utah-Arizona line and will impound a body of water 186 miles long, which will, in time, permit access by barge to areas now considered to be inaccessible to the drilling rig. Thus, the treacherous Colorado River will soon be transformed into an avenue whereby all of southern Utah will be opened up. It must be emphasized that much of the Kaiparowits basin is now readily accessible, and a nominal amount of road-building could put a drilling rig into many parts of the region.

Early efforts to find oil . . . The first prospecting for oil and gas was performed by Ohio Oil Co. in 1921, when they cable-tooled a hole on the Circle Cliffs upwarp. The endeavor went to a total depth of 3,212 ft. and tested the top of the Mississippian, but failed to encounter any significant shows of oil or gas.

No further drilling was done until 1930, when the pioneering Midwest Exploration Co. drilled a 4,436-ft. test on the Butler Valley anticline, in 14-39s-1w, Kane County, Utah. Some minor oil shows were reported, but activity in the region ceased until after World War II.

Recent attempts . . . In 1948, California Co. moved into the Kaiparowits basin and drilled two important tests. California Co. 1 Johns Valley was drilled to a depth of 10,335 ft. in 22-35s-2w, Garfield County, Utah, and encountered oil in the Timpoweap limestone member at the base of the Triassic Moenkopi formation. Oil and water were swabbed from the well for a period of time before the venture was abandoned. California Co. 1 Upper Valley, drilled in 12-36s-1e, Gar-

field County, Utah, swabbed water and 27.2°-gravity oil from the Timpoweap member and the underlying Permian Kaibab dolomite at depths between 6,041 and 6,302 ft.

Black oil, 17° gravity, was also swabbed from a zone at the top of the Mississippian Redwall dolomite at a depth of 8,760 ft. Tests were conducted for over half a year in a vain attempt to make a commercial producer out of the well. Since there has been only one drilling operation on or near the crest of the large Upper Valley anticline, there may be some question as to whether or not the feature was adequately tested.

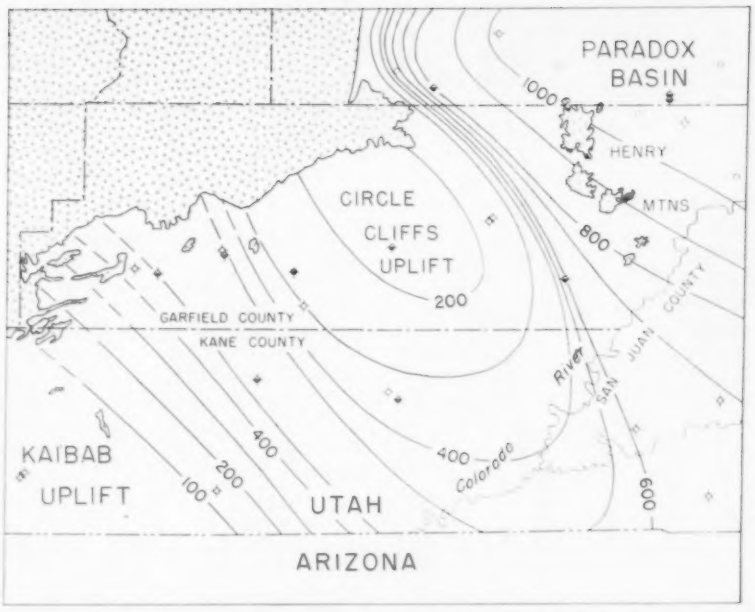
Oil shows reported . . . Following the abandonment of the two aforementioned tests, 10 wells have been drilled in the Kaiparowits basin and the immediately surrounding region. Of the 10 wells, all were abandoned, but 4 had significant shows of oil.

Foremost among these was the oil show obtained in California Co. 1 Muley Creek test, 18-36s-10e, Garfield County, Utah. The Permian White Rim sandstone had oil shows through 70 ft. of section, and one zone between 3,940 ft. had solid saturation of 33°-gravity oil. The zone was drill-stem tested without success, and no further attempt was made to complete the well by using such devices as fracture treatment.

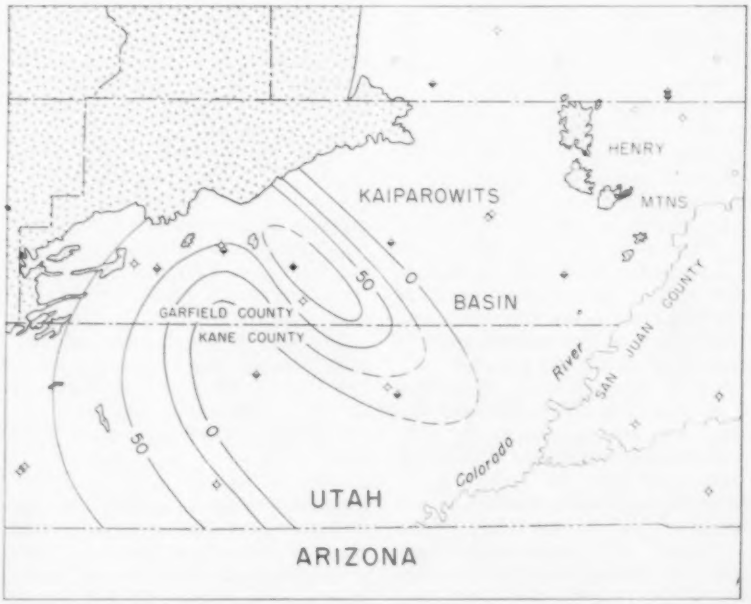
Another well having good oil shows was one drilled by Lion in the western part of the region. This well was located in 10-36s-4w, Garfield County, Utah, west of the great Paunsaugunt fault. The best shows consisted of streaked saturation in Permian rocks associated with evaporites, at depths between 10,713 and 10,974 ft. The Permian evaporites will be discussed later, and these same zones are considerably shallower at locations east of the north-south trending Paunsaugunt fault.

Geology favorable . . . Geologically, the stratigraphy and structure of the Kaiparowits basin is encouraging for commercial oil or gas production. The pre-Pennsylvanian history of the basin is similar to that of the neighboring Paradox basin. Of the pre-Pennsylvanian formations, the Mississippian Redwall dolomite appears to hold the most promise for oil or gas production, inasmuch as it is widespread and universally "full of holes."

The vuggy to cavernous porosity of the Mississippian dolomites and limestones is well known among subsurface geologists working in the region. Commercial oil production is now established in the Mississippian section at Big Flat in the Paradox basin, 120 miles northeast of the heart of the Kaiparowits basin. Since oil was swabbed from the Mississippian at the Upper Valley test, the Redwall dolomite must be regarded as a prime objective in any drilling operation conducted in the Kaiparowits basin.



THE PENNSYLVANIAN LIMESTONES and sandstones in the basin are very similar to those in the Paradox basin. Contours show net carbonates in the Pennsylvanian and Wolfcampian. Fig. 1.



ONLY THREE WELLS have penetrated a well-developed Toroweap formation, and all three have logged significant oil shows. The contours delineate the evaporite basin. Fig. 2.

Uplift and erosion . . . After the deposition of the Mississippian rocks, the entire region was uplifted and subjected to erosion. Therefore, there is a marked erosional unconformity between the Mississippian Redwall dolomite and the overlying Pennsylvanian beds. After the initial uplifting, moderate orogenic activity commenced in the early Pennsylvanian. The orogeny was part of the Ancestral Rockies mountain building that manifested itself from Texas west into Utah and Nevada during the Penn-

THE NUMEROUS STRUCTURES and the favorable stratigraphy provide ample incentive for an active exploration campaign in the Kaiparowits basin. The majority of the wells drilled have logged shows of oil. Fig. 3.

sylvanian period. Many important oil basins were formed at this time, including the Paradox basin that holds the Four Corners oil production.

In the region under discussion, two prominent uplifts came into existence. The Kaibab uplift formed in the southwest part of the region, and a lesser uplift, the Circle Cliffs, formed in the eastern part of the region (Fig. 1). These uplifts were perhaps not as intense as better-known highlands such as the Uncompahgre uplift of western Colorado, but they had a profound effect on the sedimentation in the Pennsylvanian and Permian.

A mild depression, in the vicinity of the present Kaiparowits basin synclinal axis, also formed in the early Pennsylvanian separating the Circle Cliffs uplift from the Kaibab uplift. While the depression formed at this time does not warrant being termed a "basin," a Permian sedimentary basin did develop later in the same general area, and the use of the term "Kaiparowits basin" is not poorly taken.

Pennsylvanian events . . . Middle Pennsylvanian limestones and sandstones were deposited across most, if not all, the Kaiparowits basin despite the presence of the uplifts. The units thin and have increased amounts of intraformational unconformities in the vicinity of the uplifts.

The Pennsylvanian limestones and sandstones correlate with the Hermosa formation of the Paradox basin, and have much the same character. The famous Paradox salt member of the Hermosa formation, however, is present only in the extreme northeast portion of the region under discussion, and is absent in the Kaiparowits basin proper.

Where the Paradox member is developed, of course, excellent oil and gas prospects exist because of the presence of reef-like structures within the formation. The prolific oil production in the Four Corners area is from the Paradox member of the Hermosa formation.

The arm of the Paradox salt and anhydrite unit that enters the northeast part of the region is known as the "Caineville embayment." It is currently being actively explored with the drill bit.

Permian deposits . . . After the deposition of the Hermosa, the region was uplifted in its entirety until later in the Permian, when a basin developed in the vicinity of the present Kaiparowits downwarp. This basin collected several hundred feet of limestone, dolomite, sandstone, and anhydrite belonging to the Toroweap formation, which crops out in the Grand Canyon of Arizona.

It is in the Toroweap formation that the previously described Lion well had good oil shows. Only three tests penetrated the Toroweap in the area where it is well developed, and all three had significant oil shows. Fig. 2 shows the location of the Kaiparowits evaporite basin.

Other evaporite basins are known to exist in the Toroweap formation toward the west, but only the Kaiparowits basin has been defined. The Toroweap formation changes facies to the north and east into massive, clean sandstones. The well-known Coconino sandstone is, for the most part, a sandy facies of the Toroweap formation. The Peaker 1-A Gates, 13-35s-4e, Garfield County, Utah, did not penetrate a true Toroweap section, but did drill a section that was intermediate between the sandstone facies and the evaporite facies.

Following the deposition of the Toroweap, minor uplifting occurred, then the Kaibab sea swept across all but the easternmost part of the region. The petroliferous Kaibab dolomite of Permian age was deposited, and every well that penetrated this formation had oil shows. The Kaibab also changes facies into sandstones toward the east.

The sandstone facies of the Kaibab forms a large part of the White Rim sandstone. This zone was responsible for the good oil show in the previously described Muley Creek test drilled by California Co.

Post-Permian sediments . . . The Timpoweap member of the Triassic Moenkopi formation unconformably overlies the Kaibab dolomite. The Timpoweap consists of limestone and dolomite, largely reworked from the underlying Kaibab, along with lesser amounts of sandstone and shale. The Timpoweap and Kaibab have been responsible for most of the free oil encountered in tests drilled to date in the Kaiparowits basin. After the Timpoweap was deposited on the eroded surface of the Kaibab, general uplifting took place throughout southern Utah and northern Arizona and continental conditions prevailed.

There were, however, several brief and sporadic invasions of marine waters from the west that effected the deposition of marine sandstones and limestone stringers in the lower part of the Triassic Moenkopi formation. These units are known to contain oil both north and west of the Kaiparowits basin at surface exposures, and wells have produced from them at Last Chance and Iron Wash to the north and at the old Virgin oil field in southwestern Utah. Therefore, these marine units, along with the Triassic Shinarump conglomerate, cannot be ignored in the search for oil and gas in the Kaiparowits region.

Structure . . . Generally speaking, the folding in the Kaiparowits basin is quite moderate; faulting, aside from Paunsaugunt fault zone in the western part, is virtually absent. Dips are local-

ly steep along certain linear features, but for the most part, there are few structural complexities and the rates of dips are gentle. Gently plunging noses and closed anticlines exist throughout the Kaiparowits basin and surrounding regions, and many have not as yet been tested for oil and gas. The majority of these lie in areas where stratigraphic conditions in Mississippian, Pennsylvanian, or Permian rocks are favorable for oil and gas production.

Most of the folding probably occurred during the later stages of the Laramide orogeny in the late Cretaceous. Fig. 3 shows the location of some of the more important anticlinal trends in the region. The important regional unconformity at the base of the Pennsylvanian may, in some instances, effect the transposition of the crestal axes of certain anticlines at Mississippian depth. Denser well control or seismic surveys would be necessary to determine whether or not the structural high at Mississippian depth corresponds to the surface expression of the anticline.

What lies ahead? . . . The future of the Kaiparowits basin appears bright. Within the last 2 years there has been an intensive leasing program by companies and individuals throughout the region. Among the oil companies having sizable blocks of acreage in the Kaiparowits basin are Sun, Shell, Sinclair, Sunray Mid-Continent, Tidewater and Signal. It is likely that drilling will be done in the Kaiparowits basin within the next year or so, although the writer knows of no proposed locations at the time of this writing. A discovery of any magnitude would open up an entire new basin for development, one that might someday rival its big brother, the Paradox basin, in importance.

Developments in the Kaiparowits basin will be tempered by market demand and market outlets. The nearest oil pipeline at present passes through northern Arizona, 75 miles south of the Kaiparowits basin. The region, however, will have its day of reckoning. It has the necessary stratigraphy and structure within logical drilling depths to make it one of our leading oil and gas provinces. Time and economics will guide its future.

Tough sledding for West Canada oil hunters

WITH the initial 9 months of this year gone, western Canadian discovery rate is still on the decline—a trend that has been apparent since the activity reached its peak 3 years ago.

Actually, during the period this year there has been a total of 88 new finds made in the three major oil and gas provinces of Canada (Alberta, Saskatchewan and British Columbia). Last year, statistics reveal that 104 discoveries had been registered up to the end of September from the three same provinces while the 9-month total during 1956 when rate was at its peak, showed 124 new oil and/or gas strikes.

A sudden upsurge in discovery is not looked for by companies operating in this nation although the rate, especially in Alberta and British Columbia should increase over the next 3 months as operating conditions in many exploration areas improve through frozen ground conditions. Even at that, the rate is not expected to surpass the activity of the past few years during the latter part of the year, unless favorable gas-export indications appear in the soon-to-be-released Borden Commission Interim Report.

Gas vs. oil . . . Most significant factor of the discoveries made to date this year is that a major oil find has yet to be uncovered, although the Slave Point find by Union Oil of California at Red Earth Creek cannot be overlooked. However, the trend of finding oil instead of gas in western Canada which has been apparent for many years seems to have reversed itself during the first three quarters of this year.

When records are assembled on December 31, 1958, we find it hard to imagine that anything will change the highlight of the 12 months like the British American-Shell Oil Co. gas strike in the Berland River region of central-west Alberta, or the Shell dual-zone gas strike in the Panther River region. The Berland River well contains a calculated open flow estimated at an astounding 1½ billion cubic feet per day; while the Panther River strike found gas in both the Devonian and Mississippian structures.

That Panther River strike in itself might not have registered importance if the Mississippian had been the only gas-productive zone, as it lies in the Foothills belt of southwestern Alberta where the horizon has produced such fields as Savanna Creek, Waterton and Pincher Creek to name a few. The real prominence, meanwhile, has to be in the fact that the Devonian was found and appears to be commercial.

Alberta, as in the past is still regarded as the most favorable hunting ground in Canada and this is borne out when you look at the records. This year, 58 wells have uncovered new accumulations, equally split between gas and oil. The first 9 months of last year produced 39 new oil strikes and 28 gas finds while the 9 months ending September 1956 showed 79 new discoveries made up of 36 oil discoveries and 43 new accumulations of natural gas.

Canada's No. 2 oil and gas-producing province, Saskatchewan, has compiled 18 discoveries so far this year. Of those, 17 were oil strikes and the main portion of these are situated in the southeastern sector of the province, all developed in the Mississippian horizon and none too earth shattering. That rate compares to 38 the first 9 months of 1956 and 25 at this time last year. Both those previous 2-year totals were also dominated by oil finds, as, along with the one gas deposit found so far in 1958, one had been found up to the end of September 1956 and two during the same period of 1957.

Rounding out the totals and still very much a virgin territory, British Columbia, particularly the northeastern sector of it, shows 12 discoveries so far this year, one oil strike and the remainder gas discoveries. Last year that province had scored 10 oil finds and two gas strikes; while the previous 9-months in 1956 had shown 7 discoveries, all of which were gas finds.

Drillers set to probe Sooner soil

A DEEP Anadarko basin wildcat may go down near Hinton in Caddo County, Oklahoma.

Magnolia Petroleum Co. reportedly has made location for a 15,000-ft. Ordovician test in 12-11n-11w. This lies just southeast of the town of Hinton. The company controls about 10,000 acres within a 4-mile radius of the area concerned. Gulf, Ohio, Cities Service, and Sinclair are also represented in Magnolia's block.

This well site, although tentative at this time, is northeast of Howell, Elliston et al. 1 Anadarko basin, a deep wildcat now drilling below 18,430 ft. It is also northeast of the old Superior Oil Co. Weller well which at one time held the world's depth record.

Extensions fatten Alabama's Citronelle

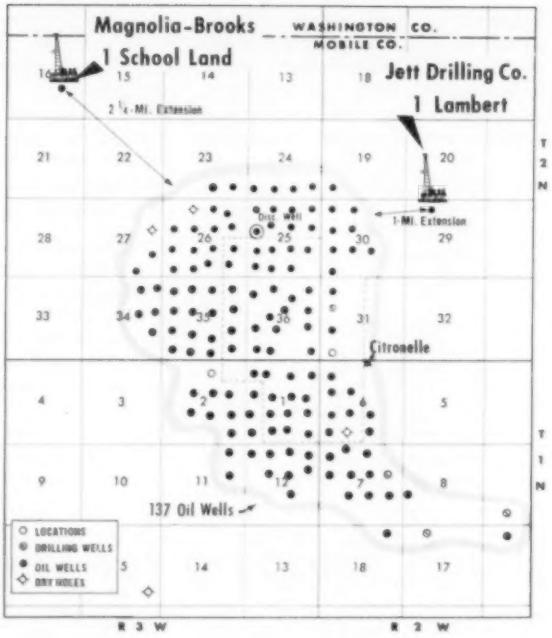
TWO newly completed long-extension wells may add more than 10,000 acres to the already large productive area of southwestern Alabama's deep Citronelle field.

One of the wells, Magnolia Petroleum Co. and Zach Brooks Drilling Co. 1 School Land, is 2¼ miles northwest of production. It is 8½ miles northwest of the field's most southeasterly well, also a long extension completed last April.

The other well, Jett Drilling Co., Inc., 1 Stella Lambert, is a mile east of production at the field's widest east-west point. It increases the width of the productive area at this point from 3 to 4 miles.

If all the area bounded by these extremities proves productive it will total 34 sq. miles, or 21,760 acres. Field limits before completion of these wells extended 6 miles from the most northwesterly to the most southeasterly well, and 3 miles from the most westerly to the most easterly well. With these boundaries, the area was 18 sq. miles or 11,520 acres. This represents a difference of 10,240 acres.

The Magnolia - Brooks extension well was completed flowing 48 bbl. of 44°-gravity oil daily through 9/32-in. choke from the field's lower Rodessa zone with 6 ft. of perforated interval at 11,602-12 ft. Jett's well, east of the field, pumped 128 bbl. of 45.9°-gravity oil per day, from the field's upper Rodessa zone, perforated opposite a series of intervals between 10,966 and 11,056 ft. Neither well produced any water at completion.



POTENTIALLY productive area which may be added to Citronelle field by Magnolia - Brooks and Jett Drilling Co. extension discoveries, northwest and east of previous field limits indicated on map.

Both wells are in holes which previously had been regarded as dry. Magnolia and Brooks quit theirs last March after drilling to 11,833 ft. They went back in the latter part of July, cleaned out and ran 5½-in. casing to 11,678 ft. Testing has been under way since late August.

Jett's east extension well was drilled late in 1955, early in the development of the field, by Trans-Tex Drilling Co. and R. M. Moon. It was 2¼ miles east of the discovery well, the only producer at that time. Because sands were considered too tight to produce, the hole was abandoned with total depth of 11,650 ft. Favorable results obtained by fracturing tight sands in more recent wells in the field led Jett to take over the old hole and attempt the same procedure to complete it as a producer.

Not counting the two extensions, 137 oil-producing wells have been completed so far at Citronelle. There now are six active drilling operations.

Trio seeks to extend California's Buena Vista Hills Field

THREE MAJOR OPERATORS were active with extension tests in the northwest end of Buena Vista Hills field in Kern County. All had as their objective the Stevens zone of the 555 pool.

... Richfield Oil Corp. was wall scraping to run liner in 554 ROCO-United A, a 5,757-ft. extension test in NE SE 20-31s-23e. Richfield plugged it back to 5,410 ft. for the completion try.

... Standard Oil Co. of California was preparing to complete a 5,625-ft. stepout in NW NE 29-31s-23e. This is about ½ mile southwest of Richfield's well.

... Tidewater Oil Co. was completing a 5,572-ft. well in NW SW 20-31s-23e. This is ½ mile southeast of Richfield's test and ¾ mile northeast of Standard's. On a Johnson formation test of the Stevens at 5,519-65 ft., it flowed at the rate of 1,656 bbl. daily of 27.8° gravity, 0.1% cut, 530 M.c.f. gas.

All of these wells are in the area of Tidewater's Upper Miocene Stevens discovery of the 555 pool last November in SW SE 20-31s-23e.

Rancho golf test . . . Signal Oil and Gas Co.'s wildcat on the Rancho Golf Course in West Los Angeles appears to be even better than was first indicated.

After testing at a rate of 1,010 bbl. daily from a 230-ft. zone bottomed at 9,500 ft., Signal ran a test on a 635-ft. interval above the earlier test and got 2,800 M.c.f.d. of gas and 110 bbl. daily of 56.6° condensate through an 18/64-in. choke. Tubing pressure was 2,350 psi.

California highlights . . . Richfield Oil Corp. abandoned its fifth dry hole in the Elkhorn Valley, 7 miles south of Taft in Kern County. This latest Richfield Elkhorn test was taken to only 3,143 ft. An earlier Richfield wildcat in the valley was drilled to 7,037 ft. depth.

Neaves Petroleum Developments Corp. hit a snag on its LaHonda wildcat in the remote regions of San Mateo County when electric logs failed to show anything encouraging and the test was abandoned at 2,465 ft. . . . Standard Oil Co. of California missed with its latest effort to extend production in the Roberts Island gas field in San Joaquin County. Standard threw in the towel at 5,375 ft. on 1 Allen Community located a little less than ½ mile southeast of production.

Five wells completed in Panhandle

FIVE NEW PRODUCERS were completed in western Oklahoma by Sunray Mid-Continent Oil Co., including one dual gas producer, one oil well, one exploratory gas well and two development gas wells.

The wells are all within the company's newly established Panhandle area which embraces western and Panhandle Oklahoma, Panhandle Texas and southwestern Kansas.

• The 1 Blouse-Vaughan, NW SW NE 5-25n-25w, Harper County, tested gas at the rate of 2,740 M.c.f.d. through a ½-in. choke upon completion in the Hoover zone at 4,288-93 ft. Deeper in the hole, the well tested at the rate of 1,250 M.c.f.d. of gas after perforations from 5,579 to 5,582 ft. opposite the Tonkawa zone. The well is in Laverne field.

• The 1 C. V. Conner, C SE SW 33-3n-25eCM, Beaver County, was completed as a stepout gas well in Southwest Mocane field area and tested at the rate of 1,450 M.c.f.d. of gas through a 16/64-in. choke. Production is from the Tonkawa zone with perforations from 5,656 to 5,666 ft. and from 5,688 to 5,700 ft. Tubing pressure was 900 psi.

• The 1 O. Marker, C NE½ 11-25n-26w, Harper County, tested at the rate of 683 M.c.f.d. of gas through a 1-in. choke with a tubing pressure of 850 lb. No open-flow test has been made. The well is producing from the Hoover zone at a depth of 4,452-58 ft. The well is in Laverne field.

• The 1 H. K. Hill, C SW NW 7-25n-25w, Harper County, still awaiting an open-flow test, was completed in Laverne field's Morrow zone at a depth of 7,360-68 and 7,382-98 ft.

• The 1 C. Brown, C SE SE 18-1n-21eCM, Beaver County, was completed as an oil well in Northwest Dower field. After perforations at 7,435 to 7,447 ft. opposite the Purdy zone, the well pumped 79 bbl. of oil in 24 hours on a natural completion without fracture treatment. Oil gravity is 37°. The hole was drilled to a total depth of 8,053 ft.

Wilcox pay spreads in Webb County

WILCOX OIL PRODUCTION is taking a long jump into northeastern Webb County, in Southwest Texas, with a new discovery in the old Adami Mirando (Jackson) sand field.

The new Adami discovery is by General Crude Oil Co. at its 1 Canales, completed with a daily flow rate of 130 bbl. of 40°-gravity oil through 13/64-in. choke.

Its Wilcox pay, new for that part of the county, is perforated at 5,172-80 ft. Its flow is with gas-oil ratio of 314 cu. ft. per barrel and pressure 130 psi.

The nearby Mirando production in the field, discovered in 1939, is from a 1,000-ft. sand.

General Crude's Wilcox well had been drilled to 7,517 ft. Drilling already is under way on the company's second deeper-pay exploratory test with location immediately south of the first. It is projected to 7,700 ft.

Adami is near the common corner of Webb, Duval, McMullen, and La-Salle counties.

Oklahoma's Harper gets prolific gasser

PROLIFIC GAS PRODUCTION is reported at Cities Service Oil Co. 1 Dunnaway-B in C NW SE 9-26n-25w, Laverne district, Harper County, northwestern Oklahoma.

This field well flowed on calculated open-flow test 207 M.M.c.f.d. from Hoover-Pennsylvanian sand at 4,118-43 ft.

This is another well in one of the most prolific and fast-growing gas fields in the Mid-Continent. The Morrow sand section at 6,849-54 ft. got 52 M.M.c.f.d.

Michigan scores another reef well

FOURTH CONSECUTIVE offset Niagaran reef oil completion in the Casco-Peters play, St. Clair County, was recorded to give the area top prominence in Michigan and challenge the declining play in Hillsdale County.

Glen Mills and Basin Oil Co. 1 Kammer, NW NE SW 22-4n-15e, southwest diagonal offset to a producing well, logged reef zone at 2,386½ ft. and drilled oil and gas saturated core to 3,635 ft., where 5-in. string was cemented. Spudded from 3,635 to 3,642 ft., the well flowed oil into pits at estimated rate of 20 bbl. per hour. Three new starts were reported.

Scipio . . . Active rigs in Scipio field, Hillsdale County, dropped to one, with only scattered drilling in promise for the future unless new extensions develop. A blow to expansion hopes occurred with Donald E. Davis 1 Wooden, NW NW NW 10-5s-3w, logging Trenton objective at 3,546 ft. and drilling out dry to 3,975 ft. Test was located ½ mile west of producing wells on the north end.

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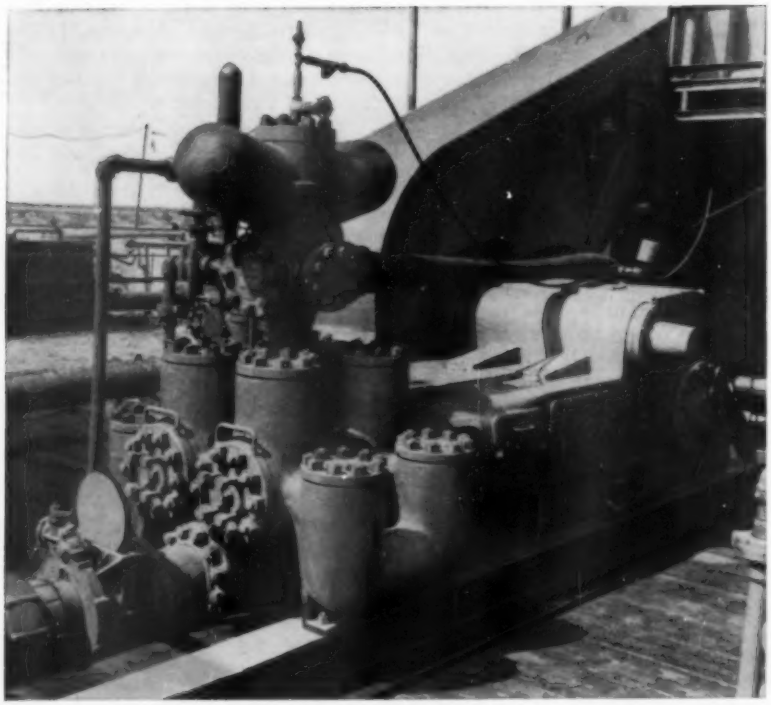

Make all future replacements with National Pulsation Dampeners!

This picture shows one of the new National Pulsation Dampeners that have been serving in the field on a long, severe test period. The aim of this field trial was to determine whether this new unit would eliminate the expensive, time-consuming operational and maintenance problems of other dampener designs.

How close we came to a bulls-eye can be gauged from the fact that when this user reviewed the results, the word went out to make all future replacements on the company's pumps with National Pulsation Dampeners!

This is not surprising, when you consider that the new National design completely eliminates troublesome rubber diaphragms, bags, and sleeves. The only rubber element is a simple disc valve, which can be replaced easily and inexpensively. Furthermore, the units operate on rig air; no separate supply of high pressure air or nitrogen is needed for precharging. A valve functions automatically to retain air pressure when the pump is shut down.

National Pulsation Dampeners are designed for use on all large pumps in the 500 hp-and-up range. They handle up to 5000 lbs. working pressure, are tested to 8000 psi, and are available as original equipment or for replacement on any of the pumps in the field. Ask or write for a bulletin which describes this newest addition to our drilling accessory line.

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Wyoming gas strike confirms Mesaverde

MESAVERDE - CRETACEOUS gas production at Wyoming's Desert Springs Unit field, Sweetwater County, was confirmed last week by El Paso Natural Gas Co. The 5 Desert Springs Unit, C SE 4-20n-98w, flowed open 17,700 M.c.f.d. from Almond-Mesaverde perforations at 5,702-79 ft.

This well confirms the original discovery of Mesaverde gas at Desert Springs last year. Two other wells in the field's development program got gas from the Lewis. Another well was a dry hole.

Desert Springs is the field discovery that set off the current flurry of wildcat activity throughout the eastern side of the Green River basin.

Powder River basin adds Dakota oil

THE POWDER RIVER BASIN in northeastern Wyoming has another Dakota oil discovery. True Oil Co. 1 Krause, N½ NW SE 33-49n-68w, Crook County, is reportedly flowing at the rate of 20 bbl. per hour.

Not all drilling data at this Coyote Creek area wildcat has been released, nor are test details official. Perforations are at 6,485-87 and 6,474-78 ft. Location is 2½ miles southeast of South Donkey Creek-Dakota Cretaceous field.

Colorado's Piceance taps gas production

NEW GAS PRODUCTION is reported in northwestern Colorado's Piceance Creek basin.

American Metral Climax Co. 2 Government, NE NE SW 31-7s-104w, Garfield County, flowed 1,100 M.c.f.d. from the Dakota, Buckhorn, and upper Morrison formations.

Location is 2 miles west of the same firm's discovery at Prairie Canyon field. That discovery made 3,100 M.c.f.d. from Dakota at 3,674-3,729

Swanson River well coring in Alaska

Standard Oil Co. of California was coring 3 Swanson River Unit at 11,208 ft. This well is about 1½ miles southeast of the Swanson River discovery well on the Kenai Peninsula. The discovery well found pay at 11,150-11,215 ft.

Cores available at Texas University

SOME 7,000 FT. of well cores from oil-bearing West Texas formations are a new addition to the University of Texas Bureau of Economic Geology's well-sample and core library.

The bureau now has 63,000 ft. of well cores from all parts of Texas.

Gulf Oil Corp. contributed the new well cores which represent material from most oil-bearing formations encountered in West Texas drilling.

"The gift is especially valuable because the bureau's well-sample and core library collection did not include much core material from West Texas," Dr. John T. Lonsdale, bureau director, said.

Well samples from approximately 38,000 wells — representing about 11,000 miles of drilling—are now on file in the unusual library, which furnishes geologic correlation data to oil explorers, drillers and petroleum-industry researchers.

The bureau's core library contains specimens from a large portion of Texas. Bureau geologists said they hope eventually to have a collection representing complete subsurface coverage of Texas.

"Many geologists from the petroleum industry come to the well-core library each year to study samples and cores," Dr. Lonsdale pointed out. "For many parts of the state the bureau collection is the only one available for information used in planning exploration for additional oil reserves."

Starr County adds condensate area

DISCOVERY of a new gas-condensate producing area in northeastern Starr County, Southwest Texas, is reported by S. H. Howell, of Alice, Tex.

Its discovery well, 2 Heard Heirs, is about a mile south of El Benadito field, and about the same distance east of La Copita field. It is rated good for 21,200 M.c.f.d. of gas, open flow, with liquid (64.6°-gravity condensate) recovery of 14 bbl. per 1 M.M.c.f..

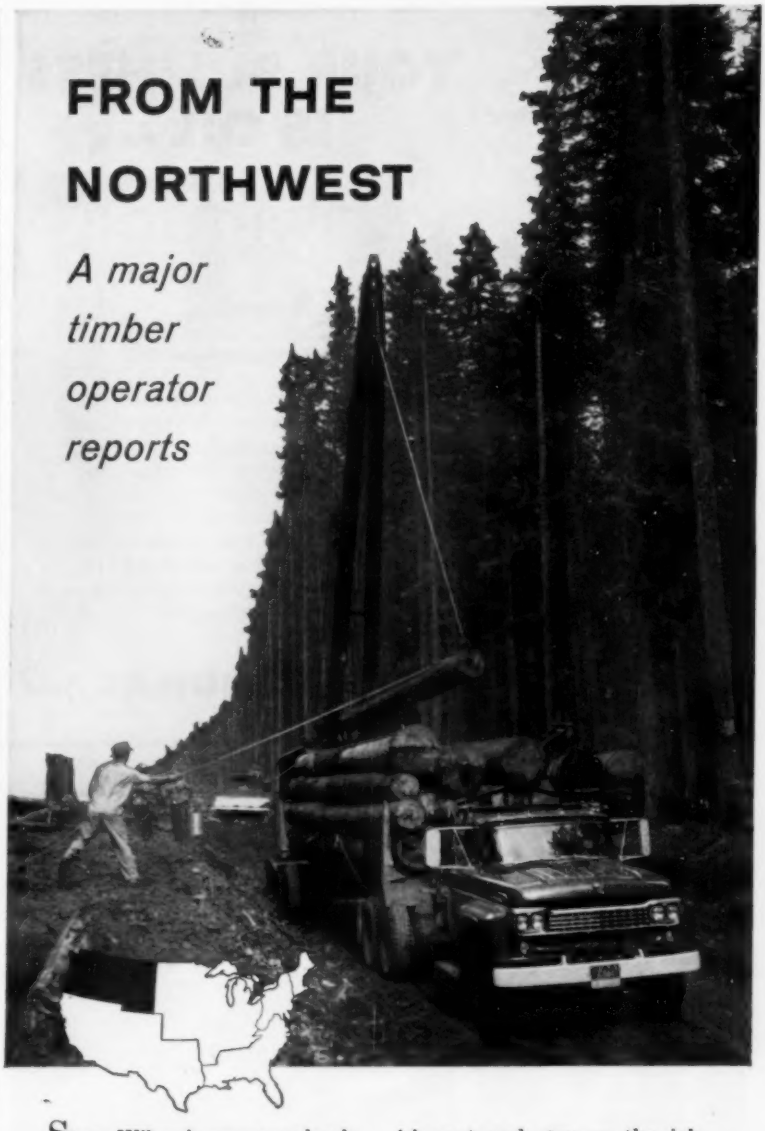
Pay, in hole drilled to 6,641 ft., is perforated at 5,529-39 ft. and 5,543-46 ft. Shut-in pressure on the well is 2,147 psi.

Location is 10 miles south of Delmita. It is about 1¼ miles northeast of Howell's first test, a dry hole, in the area. The latter was an old Shell Oil Co. test.

Both El Benadito field, to the

FROM THE NORTHWEST

A major timber operator reports



Steve Wilson's company hauls logs from mountainous Oregon timber stands—over crude roads with grades up to 18%.

Mr. Wilson has 43 Ford trucks and tractors that haul nearly 300,000 board feet of logs and rough lumber a day.

"I can't think of a tougher job for a truck than my operation," says Steve Wilson. "I need trucks that can take punishment and *stay* on the job. If a load of logs isn't delivered on schedule, I can lose plenty."

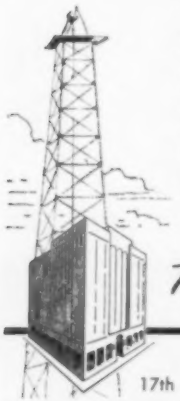
The tractor in the picture is a 1958 Ford T-850.

It is powered by a 534-cubic inch V-8 engine. Rear axle ratio is 6.69 to 1, wheelbase is 192 inches. It is equipped with a 5-speed main transmission and a 4-speed auxiliary, and grosses 72-76,000 pounds.

"Diesels used to walk right around us, but today it's just the opposite. This big Ford climbs a 10% grade loaded at 11 miles an hour, compared to 6 mph for our previous truck."

S. O. Wilson

President
Steve Wilson Company



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north, and La Copita field, to the west, produce oil and gas from Frio and Vicksburg sands, the former at 5,000 and 5,900 ft., and the latter at 6,900 ft. The former was opened in 1952, and the latter in 1948.

Remote wells pay in Texas' Lipscomb . . .

REMOTE Atoka-Basal Pennsylvanian oil production was opened in north-central Lipscomb County, Texas Panhandle. The Texas Co. 1 Anna Frass, opener of Frass-Atoka field, flowed 304 bbl. per day from perforations at 7,903-14 ft. Gravity is 48°.

Nearest Atoka production is 30 miles west and 26 miles south at W. J. Johnson Atoka field. Location is in Section 73, Block 10, HT&B Survey. Closest production of any sort is at East Booker-Tonkawa field, 11 miles north and 2 miles south.

and Ochiltree counties

NEW upper Morrow - Pennsylvanian oil production was opened in the southwest part of Ochiltree County in the Texas Panhandle.

Sinclair Oil & Gas Co. completed the 1 G. R. Buzzard, 10 miles southeast of the town of Waka, for 423 bbl. of oil per day, 35° gravity. Flow was through ¾-in. choke from perforations at 8,337-40 ft.

Exact spot is in Section 75, Block 13, T&NO Survey. Nearest production is 3 miles west at R. H. F.-Morrow field.

Drilling proceeds on Washington site

Standard Oil Co. of California was drilling ahead below 4,484 ft. on 12-1 Silvana Community, a wildcat in Snohomish County.

Clinton well completed in Ohio's Licking County

The Natol Corp. announced the completion of its 1 T. S. Moran, Section 3, Fallsburg Township, Licking County, as a 200-bbl. well.

The producer is its third and best completion in the new pool east of Fallsburg. Clinton sand was found at 2,944-88 ft. with pay at 2,944-82 ft.

Illinois, Indiana share new strikes

ILLINOIS BASIN developments included discoveries in Gibson and Spencer counties, Indiana, and new strikes in Effingham and Wayne counties, Illinois.

Indiana . . . A new area is growing rapidly in Gibson County, 5 miles southeast of Princeton.

Arthur J. Fritz completed the discovery well, 1 Raymond Meyer, SW NE SE 2-3s-10w. The well pumped 65 bbl. per day, natural, from O'Hara at 1,966-73 ft.

The second well in this new area, the 1 Charles G. Kruse, NE SE NE 2-3s-10w, pumped 341 bbl. per day from the O'Hara at 1,990-2,001 ft., natural.

Other active wells in this area are Don Baines and Associates 1 Kruse in SW SW SW 36-2s-10w. Completion work is under way in the O'Hara at 1,936-41 ft.

. . . Spencer. Cato Enterprises 1 W. G. Machin, SE SW SE 6-7s-5w, 1 mile west of Grandview, is an Aux Vases discovery at 1,224-35 ft. A drill-stem test at 1,224-35 ft. flowed clean oil. Production casing has been set.

Illinois . . . Farrar Drilling Co. and Walter Duncan 1 Webster, NW SW NE 36-6n-6e, 7 miles southeast of Mason in Effingham County, recovered 275 ft. of clean oil, 30 ft. mud-mixed oil and 40 ft. of heavily oil-mixed mud on a drill-stem test of the Cypress sand at 2,397-2,432 ft. The operators are preparing to test to 2,420-36 ft.

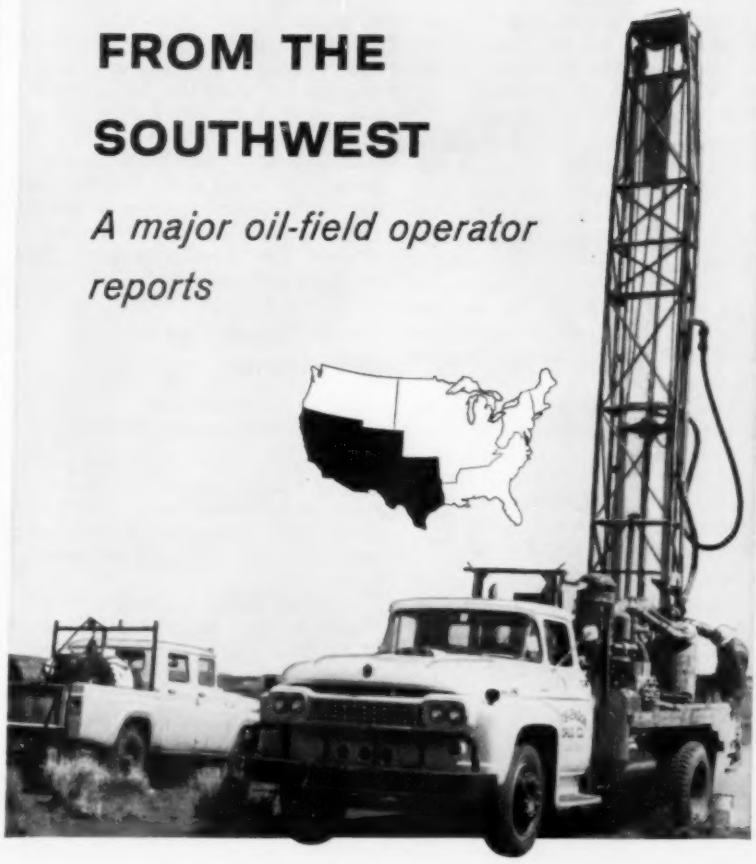
. . . Wayne. T. R. Lindsay has set casing at the 1 Clarence F. Anderson wildcat in NW SE NE 20-2n-6e, 4 miles north of Johnsonville for testing of the McClosky at 3,184-94 ft. A drill-stem test at 3,182-3,209 ft. got 1,680 ft. of clean oil and 600 ft. salt water.

Oklahoma adds well to South Powell field

South Powell field near the Red River in extreme southeastern Oklahoma's Marshall County added a good producer. It is Shell Oil Co. 3 Dickerson in SE SE SE 34-7s-4e. The well flowed 502 bbl. of 35.6°-gravity oil and 80 bbl. of water in 16 hours on 24/64-in. choke from the Des Moines-Pennsylvanian at 3,217-88 ft.

FROM THE SOUTHWEST

A major oil-field operator reports



This '58 Ford F-850 runs all day . . . but hardly moves at all.

It belongs to the Stevenson Drilling Company of Houston, Texas. The truck goes only a few miles a day but its V-8 engine runs all day long—powering (transmission PTO) a drill that's searching for oil. The combination air-water drill makes 100-ft. deep "shot holes." The oil company geophysicists detonate dynamite in these holes for seismograph recordings that reveal the location of new oil deposits.

"We are really impressed with the way these new Ford Super Duty V-8's are engineered," says W. M. Stevenson. "We normally drill on propane, through a truck's carburetor throat, but the fuel costs of our Super Duty V-8 turned out to be so reasonable that we didn't need to switch."

The Super Duty V-8 power plant in the Stevenson Company's F-850 displaces 401 cubic inches. It has a 5-speed transmission and a two-speed rear axle ratio of 6.50/8.87 to 1. Wheelbase is 175 inches, gross weight 23,000 lb.

"We have used Fords since 1946. We like the availability of Ford replacement parts, their low cost and the excellent Ford service. I plan on buying Ford trucks 100% in the future."

W. M. Stevenson

President
Stevenson Drilling Company

Keynote talk set for SFGS convention

KEYNOTE speech before the Southwestern Federation of Geological Societies at the first annual convention to be held in Mineral Wells, Tex., October 22-25, will be given by Edgar W. Owen of San Antonio.

Owen will trace the development of petroleum geology in the Southwest from the Ranger boom in 1917 to the present time. Citing the unprecedented volume of subsurface data now available and the constantly increasing load of exploration costs, he will point out the responsibility and the opportunity facing the SFGS for the advancement of the science.

Owen began his geological career in 1916 after receiving his BS from Denison University and an MA from the University of Missouri. He has worked for Cities Service Oil Co., Greenwood Co., John C. Keys, L. H. Wentz, and the Wentz Estate.

He is a past-president of the San Antonio Geological Society and has served the American Association of Petroleum Geologists both as president and as secretary-treasurer. Currently, he is acting as a consultant on stratigraphic problems and as a lecturer in geology for the University of Texas.

This speech will open a 2-day technical program with "Geologic Provinces of the Southwest" as a theme. Two panel discussions and 18 papers will stress the relationship of the areas covered by the SFGS. They are designed to bring closer together the member geological societies at Dallas, Fort Worth, Wichita Falls, Lubbock, Abilene, San Angelo, Midland, San Antonio, and Roswell, N. M.

Depositional dips in limestones

An Abstract

BY JOHN EMERY ADAMS

Classically, limestones are uniformly bedded deposits laid down as extensive horizontal sheets. This widespread flat beddedness makes them especially useful as key beds in stratigraphy.

The concept of original horizontallity is so prevalent that we instinctively reconstruct limestones that way in picturing past sedimentary environments. We also assume that limestone thicknesses should always be measured at right angles to the bedding planes.

Limestone bedding however, is almost never truly horizontal. Most deviations are slight, but deposition dips ranging from 10°-30° occur even in shallow environments. Forest beds, with dips approaching the angle of rest, are common in deeper waters. Examples of forest bedding in Cretaceous and Permian limestones of West Texas illustrate these irregularities.

Stratigraphic errors result when original angularity is disregarded. The most common error is recording excessive limestone thicknesses. Many overthick limestones in the geologic column may represent measurements of forest beds rather than true formation thickness.

Pennsylvanian reef patterns in West Central Texas

An Abstract

BY FRANK B. CONSELMAN

Pennsylvanian shelf sea sediments in West Central Texas provide an excellent subsurface laboratory for the study of productive and nonproductive reef deposits. These reefs are numerous, well-preserved, and economically important, in a region where development has been suffi-

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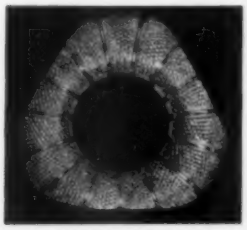

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ciently intensive to afford a wide variety of patterns and case histories.

Proceeding from accepted examples of reefs, a statement of criteria for recognition may be derived. A reef is a carbonate body whose upper surface is markedly convex, as a result of predominately organic processes. However, it is identified as such, not because of the presence of characteristic faunal or floral assemblages, nor of specific lithologic facies, but because of its form.

Criteria for recognition are not paleontologic nor petrographic, as these may be duplicated in nonreef deposits. Reefs essentially are characterized by relative topographic relief, and the surest criterion is nonstructural contour configuration.

Reefs in West Central Texas lend themselves readily to statistical classification, and a system is presented using length, width, height, and heading as principal parameters. From a study of cases and usages, quantitative expressions for reefoid bodies are derived as follows:

1. If contour closure equals or exceeds 100 ft. per mile of width, the deposit is a reef.
2. If contour closure is between 50 and 100 ft. per mile of width, the deposit is probably a reef.
3. If contour closure is less than 50 ft. per mile of width, the deposit is more properly termed a bank, and should be further checked to make sure structural influences are not primarily responsible.

Reefs are placed in five pattern categories: ridge reefs; button or round reefs ("bioberms"); chain or cluster reefs; atolls; and irregular reefs.

Existing patterns strongly suggest that many undiscovered reefs remain to be found in West Central Texas, despite the amount of exploration and drilling already done. It is believed that a detailed and comprehensive statistical analysis of the known reefs will have economic implications not only on the eastern shelf but in similar shelf sea terranes elsewhere.

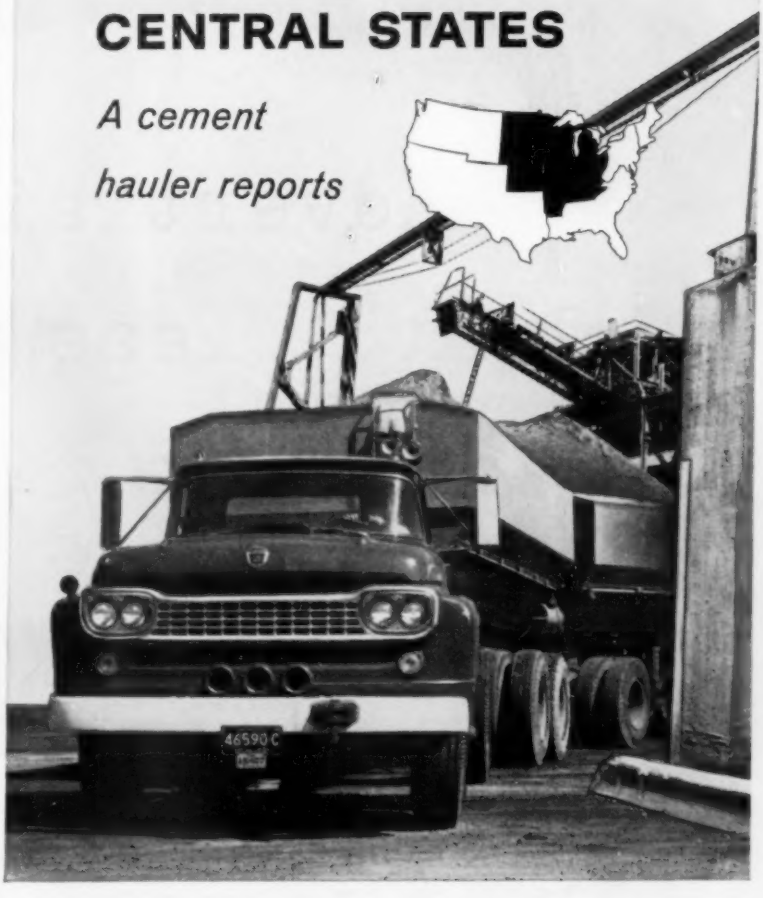
Drilling program set for Gulf Coast

A SIX-WELL WILDCAT drilling program launched recently by Ada Oil Co. in northern Hardin County, Texas Gulf Coast, is being augmented by another program which Ada, jointly with Gordon Street, Inc., is starting. It involves the drilling of five wells, also in Hardin County, but extending into Newton County.

The first well of the new program is a projected 8,000-ft. test, 1-G Sternenberg, in the Stewart Newell Survey,

FROM THE CENTRAL STATES

A cement hauler reports



Carl Harrison, Inc., is a limited common carrier of bulk cement operating out of Dearborn, Michigan. The Ford F-1100 shown above is the biggest of the firm's six Ford trucks.

This F-1100 grosses 98-100,000 lb. pulling doubles. Payload is 64,000 lb. (170 barrels of cement). Company President Carl Harrison makes the point that the low curb weight of Ford trucks allows him to carry bigger payloads. "The curb weight of this Ford tractor is almost half a ton less than another make we have used on this job."

Carl Harrison's shrewd appreciation of efficient, economical equipment is further evidenced by the fact that his bulk cement semi-trailers are custom-built to his own design.

Additional specifications of this F-1100: 534-cu. in. Super Duty V-8, 5-speed transmission, 2-speed rear axle, 144-in. wheelbase.

"And as far as power is concerned, this big Ford has really got it. She saves time on every trip, time that means money to us."

Carl Harrison

President
Carl Harrison, Inc.

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Progressive managements realize they must make effective use of all the channels of communicating with markets — salesmen, publication advertising, direct mail, trade shows, catalogs, films — if enough products are to be sold to insure full-scale employment and full use of production facilities.

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5½ miles northwest of Kountze. It, and all the other wells, will evaluate the Cockfield, Yegua, and Wilcox potentialities.

Drilling now is under way on the third wildcat in Ada's six-well program. The first well, 1-B Sternenberg, 6 miles north of Kountze, was abandoned recently. The second, 1 Kirkpatrick, 9 miles northwest of Kountze, is near its depth objective of 7,700 ft. The third, 1 Stapleton, 1½ miles northeast of Kountze, is projected to 8,200 ft.

Production tests at deep Pecos wildcat

OPERATORS continued to make flow tests at an indicated gas discovery in central Pecos County, West Texas.

Phillips Petroleum Co. 1-A Harrall flowed at the rate of 1,062 M.c.f.d. of gas through ¾-in. choke. Perforations were in the Wolfcamp section, between 15,700-20 ft.

Total depth at 1-A Harrall was 19,020 ft. Casing was set on bottom, then the hole was plugged back to 15,753 ft. Location is 15 miles east of Fort Stockton, in Section 6, Block 126, T&STL Survey.

Ordovician pays in central Oklahoma

FURTHER ORDOVICIAN success is noted in south-central Oklahoma . . . this time just northwest of Norman. Gulf Oil Corp. 1 Bass, SW NE 36-9n-4w, found the Oil Creek sand at 10,693 ft. There was a gas show at 10,699-10,718 ft. Logs denote about 6 ft. pay zone above the water. Casing was landed at 10,672 ft. for tests.

This well previously had found gas and oil in the Tulip Creek sand. A drill-stem test at 10,209-47 ft. got 4,450 M.c.f. of gas daily and 15 bbl. of oil hourly.

Sweetwater leads at Green River

AN EARLY OCTOBER survey of drilling operations in the Green River basin, one of Wyoming's many busy spots this year, shows that Sweetwater County leads the pace.

- Gulf Oil Corp.'s State Line prospect in C SW NE 11-12n-94w, is drilling below 7,302 ft. The 1 Government found gas shows on several tests. A test of the Wasatch-Tertiary got 4,220 M.c.f. per day. This wildcat is a Lewis test to about 7,600 ft.
- Mountain Fuel Supply Co. is reaming at 2,023 ft. at the 2 Pioneer

FROM NEW ENGLAND

A nationally operated dairy reports

"Milk and dairy products make highly concentrated loads," says Elnathan Mitchell, President of Mitchell Dairy. "We need a bigger, stronger tractor than usual for our gross of about 50,000 lb. We decided to try a new Ford Tilt."

Mitchell Dairy, an affiliate of The Borden Company, has headquarters in Bridgeport and serves almost the entire state of Connecticut. The dairy's Ford C-1000 Tilt is on the job seven days a week, hauling canned and bottled milk from Bridgeport to outlying distribution plants.

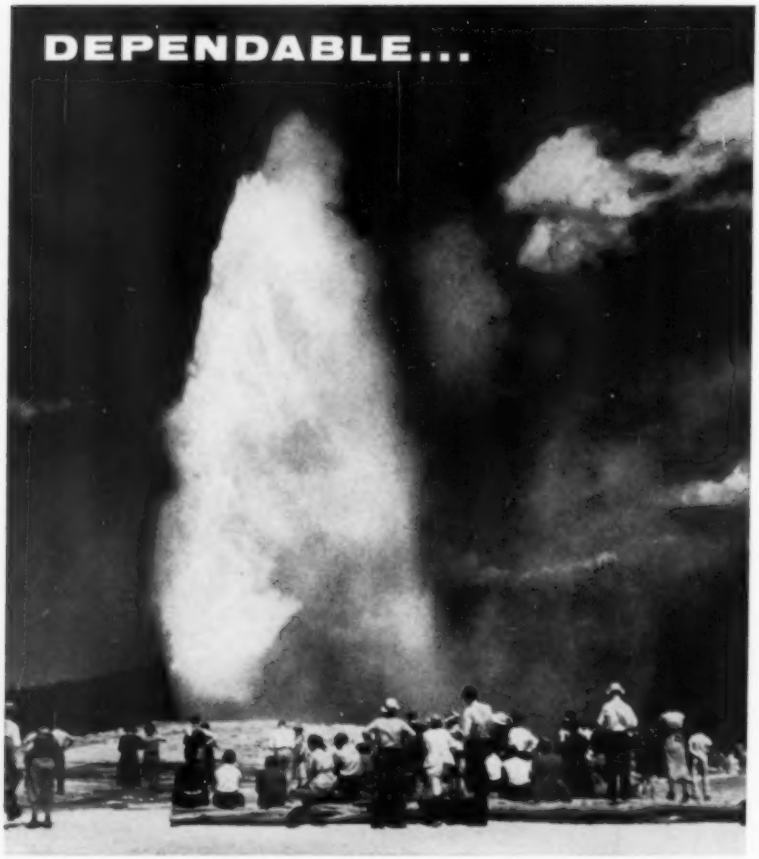
This big Ford operates both in heavy city traffic and on expressways. Comments of drivers: "She makes it really easy to handle trailers in tight areas". . . "There's practically no shifting once she gets up to cruising speed". . . "Outpulls any tractor in the fleet."

Mitchell's Ford C-1000 Tilt Cab tractor has a 477-cu. in. V-8, five-speed transmission, 6.71/9.13 to 1 two-speed rear axle ratio, 99-inch wheelbase.

"We bought this Ford Tilt Cab truck chiefly because of its maneuverability and its low curb weight—over 1,000 lb. lighter than competitive tractors. That means our legal payload can go better than 30,000 lb."

Elnathan Mitchell

President
The Mitchell Dairy Company



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Unit, SE SE NE 18-13n-99w. The same company is drilling below 4,105 ft. at 3 Trail Unit in NW NW SW 3-13n-100w, 1 mile south of a new pay discovery.

- Mountain Fuel Supply Co. is drilling another wildcat at 1 Horn Canyon Unit in C SE SE 13-23n-110w.
- Ohio Oil Co. is below 11,542 ft. at the B-1 Wamsutter Unit in E½ SE 1-19n-94w. This one will go to 13,300 ft. There have been gas shows on both cores and tests. This well is 8 miles southeast of the field discovery well.
- Pubco Petroleum Co. is running tubing for tests at the 1-34 in C SW 34-21n-98w, west of Desert Springs field.
- El Paso Natural Gas Co. is getting ready to drill the 1 Black Rock Unit in C SE 8-22n-99w. This Mesaverde test will go to 6,000 ft.
- El Paso is also going to drill a 4,000-ft. pre-Tertiary wildcat at Bridger Hill.
- Ohio is drilling below 9,097 ft. at the 1 Mud Lake Unit in C NW NW 12-23n-98w. This test is a 10,085-ft. Mesaverde wildcat.

Dakota pool opens in Nebraska

DAKOTA "J" sand oil production was opened by Drilling & Exploration Co., Inc., et al., at the 1 Forest Hinshaw in the Enders area of Kimball County, Denver basin, Nebraska.

This well is in 12-13n-55w, 2 miles northeast of Enders field. After fracture, the well swabbed at the hourly rate of 20 bbl. for 12 hours from perforations at 6,202-07 ft. Preparations are now being made to install pumping equipment. The group has a solid block of about 3,500 acres in the immediate vicinity of the discovery.

Enders field, nearest production produces from the Dakota "J" sand (Cretaceous). There are 31 producing wells in this field.

Central Arkansas' gas reserves upped

CENTRAL ARKANSAS' development of gas reserves was boosted again last week by a dual-zone discovery east of Old Hickory, in Conway County. It is 3½ miles southeast of Jerusalem field, nearest production.

The new discovery well, 1 Barrett, drilled by J. G. Beard Estate, of Oklahoma City, is productive from two Barton sands, one perforated at

2,875½-91½ ft., and the other at 2,668-82 ft. Total depth is 2,896 ft.

The lower zone flowed at the rate of 2,920 M.c.f.d. of gas through ⅜-in. choke under pressure of 800 psi. The upper zone made 470 M.c.f.d. of gas through the same-sized choke. Shut-in pressure is 1,125 psi. That of the lower zone is 1,245 psi.

Texas' Ward County deep test started

ANOTHER deep prospector for northern Ward County is slated by Magnolia Petroleum Co. Their 1 George Sealy "Section 56," will be drilled to 17,000 ft.

Location is SW SW Section 56, Block F, G&MMB&A Survey. It is 2 miles southwest of the Magnolia Sealy field, and 5 miles northwest of Wickett. Drill site is on a 640-acre lease.

Earlier this year, Magnolia's 1 George Sealy "Section 88" was scheduled as a deep exploration, but stopped drilling short of its goal when it made a heavy producer in the shallow Delaware sand.

Texas' Scurry adds Canyon opener

EXPLORATION in the Eastern Shelf area of central West Texas has added a new Canyon sand pool southwest of the Hermleigh fields.

Empire Drilling Co. and G. F. Ray, Midland, 1 Wayne Rogers flowed 281 bbl. of oil a day through 24/64-in. choke on potential test. Perforations at 6,325-44 ft. had been acidized with a light shot, and then fractured with 15,000 gal.

Location is SE SE Section 54, Block 3, H&TC Survey, about 4 miles southeast of Snyder.

Gas discovery in Eddy County, N. M.

COMPLETION TESTS have been reported for central Eddy County's Morrow gas discovery. Joseph I. O'Neill 2-D Federal, pool opener 7 miles northeast of White City, rated a daily potential of 3,600 M.c.f. of gas. Shut-in tubing pressure was 3,800 psi. Production is from perforation intervals between 11,834-80 ft. Total depth was 11,920 ft.

Location is SE SE 12-24s-26e. The well is about 2 miles north Union Oil Co. of California's 1-26 Crawford, recently completed gas discovery.

FROM THE MIDDLE ATLANTIC STATES

A dump truck operator reports

"I operate all over New York State," says owner-operator Wendell Wilbur, "and loaded or empty my Ford can beat any dump on the job."

Mr. Wilbur's big 1958 Ford T-850 has a 10-cu. yd. dump body, is powered by a 477-cubic inch V-8, grosses 50,000 lb. It is equipped with 5-speed main transmission, 3-speed auxiliary, and has a 156-inch wheelbase.

"I'm in this truck all day long," says Mr. Wilbur, "and it's the smoothest riding tenwheeler I've ever driven. And talk about handling!—with power steering my rig handles easier than a lot of pickups.

"This Ford's curb weight is almost 4,000 pounds less than other comparable trucks. That means more money-making payload for me."

Mr. Wilbur has been a truck user for more than twenty-five years, and he's been a Ford user just as long.

"My Ford T-850 has real power—on the hills I can pull away from any truck around—I even leave big diesels behind."

Wendell Wilbur

Owner-Operator
Ellenville, N.Y.

Waller gets gasser

GAS FLOW of Humble Oil & Refining Co.'s latest well completed in the expansive and prolific Katy field in southeastern Waller County, Texas Gulf Coast, is rated at 290 M.M.c.f.d., absolute open-flow potential.

This makes it one of the largest gas wells brought in this year in the Gulf Coast region.

The well is productive from Cockfield sand at 6,800-24 ft. Total depth is 6,911 ft.

Actual flow through adjustable choke was at the rate of 5,639 M.c.f.d. with pressure of 2,463 psi. Shut-in pressure is 2,502 psi. Liquid recovery (58.4° condensate) was in the ratio of 18,700 cu. ft. of gas per barrel.

Lea County gets Devonian extension

A BIG DEVONIAN step-out has been completed in the relatively new and hot area of South Vacuum field, in central Lea County.

Pure Oil Co. 2-35 South Vacuum Unit, in NE SE 35-18s-35e, flowed 252 bbl. of 49.5°-gravity oil in 8 hours through 16/64-in. choke, for a daily rate of 1,008 bbl. Producing horizon was the Devonian, through perforations at 11,680-11,730 ft. Flowing tubing pressure was 400 psi.; gas-oil ratio was nearly zero.

The extender will also try for completion as a gas well, and new-pay discovery, in the McKee section (Middle Simpson in age), at 13,620-13,823 ft.

Successful Wildcats

ARKANSAS

Union County: Horizon Oil Co. 1 Olin Oil & Gas Co., C SE NE NE 9-17s-13w. IP 20 BOPD, 15°, Hosston 3,440-49 ft. Deeper drilling in Wilmington pool. TD 4,205 ft. New pay, the Hosston, in Wilmington field.

CANADA

Altana 4-2-35-6 Caroline, LSD 4, 2-35-6w5. TD 10,079 ft. basal quartz gas well.

Hudson's Bay 7-20-37-23 Delburne, LSD 7, 20-37-23w4. TD 4,619 ft. Viking oil well.

COLORADO

LaPlata County: Consolidated Oil & Gas Co. 1-6 Superior-Ute, 6-33s-6w. IP 1,799 M.c.f. of gas per day, Fruitland 2,744-2,875 ft., Mesaverde 5,280-5,687 ft. TD 5,850 ft.

Mesa County: Oroco Oil & Gas Co. and El Paso Natural Gas Co. 1 Oroco-Coon Hollow Unit, 26-8s-98w. IP 1,117 M.c.f. of gas per day, Mesaverde 1,667-1,720 ft., 1,735-41 ft., 1,744-50 ft., 1,756-60 ft., 1,764-70 ft. TD 2,404 ft.

Morgan County: J. L. Cramer 1 Evans, C SW SE 27-1n-55w. IP 70 BOPD, "J" sand 4,893-95 ft. TD 4,987 ft. Opens Luster field.

Weld County: Stuarco & Lewis Bros. 1 Engstrom, C NW NW 26-7n-58w. IP 100 BOPD, "D" sand 6,356-60 ft. TD 6,453 ft.

Midwest et al. 1 Rasmussen, C SW SE 6-11n-56w. IP 42 BOPD, "J" sand 6,539-46 ft., 6,514-20 ft. TD 6,593 ft. Opens new pool in Denver basin.

ILLINOIS

Macoupin County: Genesco Development Co. 1 B. Meyer, 13-9n-7w. IP 6 BOPD, 2 BWPD, Pennsylvanian 539-50 ft. TD 552 ft. Opens South Carlinville pool.

Richland County: Jack Inglis 1 Morris Runyon, SE NE SW 25-3n-9e. IP 25 BOPD, 75 BWPD, Rosiclare 3,106-14 ft. TD 3,190 ft. Extension to Clay City Consolidated field.

Perry Fulk 1 Stoltz, SW NW NE 35-5n-14w. IP 98 BOPD, Rosiclare 2,883-87 ft. TD 2,887 ft. Oil discovery of Bowyer pool.

Shelby County: Doran Oil Properties 4 George Chaffee, NW NE 27-10n-5e. IP 35 BOPD, 12 BWPD, Aux Vases 1,949-64 ft. Rosiclare 2,021-24 ft. TD 2,024 ft. New pay in field, Rosiclare.

Wayne County: Pure Oil Co. 1 S. A. Coil, NW SE NE 6-1s-5e. IP 14 BOPD, 20 BWPD, Aux Vases 2,841-51 ft. TD 2,942 ft. Opens North Coil field.

INDIANA

Gibson County: G. C. Schoonmaker 1 F. Ross, SW SE 11-2s-9w. IP BOPW, 18 BWPD, McClosky 1,774-80 ft. TD 1,798 ft. Opens West Oakland City pool.

Spencer County: Cox Drilling Co. 1 Daniel Uebelhack, SE SW 20-5s-4w. IP 70 BOPD, Jackson 710-27 ft. TD 727 ft. Opens South Lamar pool.

Stanley Lambert 2 A. J. Sauter, SW SE SW 28-6s-5w. IP 25 BOPD, Aux Vases 1,120-28 ft. TD 1,128 ft. New pay discovery.

M. P. Evans 1 Hopkins and Farley, NW SE NE 4-7s-5w. IP 10 BOPD, O'Hara 1,129-33 ft. TD 1,135 ft. Extension to Grandview field.

KANSAS

Comanche County: Messman-Rinehart 1 Perry, 12-32s-16w. IP 10,300 M.c.f. of gas per day, Miss. 4,796-4,812 ft. TD 4,920 ft. Opens Perry Ranch pool.

Cowley County: Renfro Drilling Co. 1 J. Waldschmidt, NE NE SE 17-34s-6e. IP 71 BOPD, 38.7°, 1,821-23 ft.; Miss. 3,113-29 ft. New pay in South Waldschmidt pool.

Ellis County: Rupp-Ferguson 1 Snapp, SW SW NW 27-11s-16w. IP 296 BOPD, 37°, Lansing 3,013-18 ft., 3,080-85 ft., 3,138-46 ft., 3,148-53 ft., 3,158-61 ft. TD 3,338 ft. Opens South Chrisler pool.

Rudy Herman 1 Reidel, C E½ SW SE 27-13s-16w. IP 40 BOPD, 40% water, 35°, Arbuckle 3,502-04 ft. TD 3,504 ft. Opens Air-Braun pool.

Graham County: Murfin, Rains & Williamson 1 E. O. Johnson, SE SE SE 4-8s-23w. IP 125 BOPD, 38°, Lansing-Kansas City 3,706-10 ft. Opens East Montgomery pool.

K&E Drilling Co. and Boa 1 Stuchlik, C NE NE 7-8s-22w. IP 290 BOPD, 42.5°, Lansing 3,578-86 ft. TD 3,660 ft. Opens South Harmony pool.

Kimbark Oil Co. 1 McVey, SE NE SW 7-10s-22w. IP 165 BOPD, 40°, Lansing 3,852-55 ft. TD 3,919 ft.

Greenwood County: H. O. Butler 1 Williams, N½ S½ SE 15-26s-12e. IP 10 BOPD, 200 bbl. water, 27°, Mississippian 1,847-51 ft. TD 1,867 ft.

Kingman County: Cities Service Oil Co. 1 Chase, NE NW SE 23-28s-7w. IP 158 BOPD, 115 bbl. water per day, 37.9°, Lansing 3,599-3,607 ft. TD 4,482 ft. Opens Alameda pool.

McPherson County: Brunson Producing Co. 1 Larson, SE SE SE 33-18s-2w. IP 31 BOPD, 37°, Miss. 2,965-80 ft. TD 2,980 ft. Opens Larson pool.

Rooks County: Davis Bros. 1 Ordway "C," NW NW SW 16-10s-18w. IP 127 BOPD, 23% water, 32.8°, Lansing-Kansas City; 120 BOPD, 2% water from Simpson, 27.8°; Lansing-Kansas City 3,543-46 ft., 3,518-26 ft., 3,554-58 ft., 3,580-86 ft.; Simpson 3,678-86 ft. TD 3,720 ft. New pay discovery in Southeast Williams pool.

Sedgwick County: Graham-Michaelis 1 Ulmer, SW SW SW 10-25s-2e. IP 17 BOPD, 70% water, 38°, Burgess 2,870-71 ft. TD 2,871 ft. Opens Furley pool.

Seward County: Cities Service Oil Co. 2 Salley "C," C NE SW 16-34s-33w. IP 2,450 M.c.f. of gas per day, Toronto 4,338-42 ft. TD 6,414 ft. New field.

Stafford County: Sunray Mid-Continent Oil Co. 1 Cline, NE SW SE 25-24s-13w. IP 252 BOPD, 3% water, 35.2°, Lansing 3,594-97 ft., 3,698-3,704 ft. TD 4,160 ft. Opens Cline pool.

Sumner County: Gulf Oil Corp. 1 Fuqua, 34-31s-2w. IP 2,887 M.c.f. of gas per day, Elmont 1,845-55 ft. TD 4,238 ft. Shut-in gas well.

KENTUCKY

Henderson County: Lohmann-Johnson and Ashland Oil & Refining Co., 24-P-25. IP 87 BOPD, 15 BWPD, lime 2,316-21 ft. TD 2,429 ft. Extension to Zion pool.

McLean County: Sun Oil Co. 1 J. M. Scott, 22-N-25. IP 63 BOPD, Cypress 886-92 ft. TD 1,328 ft.

Muhlenberg County: Stouder and Ashland Oil & Refining Co. 1 F. L. Buie, 7-I-27. IP 98 BOPD, McClosky, 2,015-25 ft. TD 2,025 ft. Opens Yeargins pool.

Creek Oil Co. 1 Raymond Vincent, 5-I-28. IP 67 BOPD, Bethel 1,855-70 ft. TD 1,870 ft. Opens New Cypress pool.

Union County: W. E. Styles 2 C. S. Proctor, 10-O-20. IP 60 BOPD, 800 BWPD, McClosky 2,661-67 ft. TD 2,751 ft. Extension to Morgan field.

NORTH LOUISIANA

Concordia Parish: Germany & Gulmon 1 R. B. Sharp, 14-4n-9e. IP 43 BOPD, 43°, Wilcox 6,352-56 ft. TD 7,264 ft. Opens South Roseland pool.

1 Thomas-Wilds, C NE NE NW 21-7n-7e. IP 130 BOPD, 40°, Wilcox 5,125-26 ft., 5,131-33 ft. TD 5,982 ft. Opens Athlone pool.

R. A. Campbell 1 H. A. Turner "A," 56-8n-10e. IP 37 BOPD, 48.4°, Wilcox 5,061-64 ft. TD 5,994 ft. Opens South Clayton pool.

MISSISSIPPI

Jones County: Central Oil Co. and Lone Star Producing Co. 1 Masonite, NW NE SW 25-10n-10w. IP 303.47 BOPD, 9/64-in., 39.9°, GOR 122 cu. ft. per bbl., TP 905 psi., perforations 10,710-14 ft. (Rodessa). TD 11,927 ft. Elev. 299 ft., Lower Cretaceous 7,061 ft., first Rodessa sand 10,240 ft. (Discovery well Bryan field.)

MISSOURI

Cass County: F. O. McCain 1 R. S. Harris, SW SW NE 31-45n-32w. IP est. 150 M.c.f. of gas per day, Cherokee. TD 538 ft. Gas Discovery.

EASTERN NEW MEXICO

Roosevelt County: The Texas Co. 1 Chapeau-Federal, 12-8s-35e, 3 miles southeast Milnesand. IPP 16 BOPD, 42° gravity, GOR 1,470, Pennsylvanian 9,237-9,536 ft. TD 9,809 ft. Elevation 4,175 ft.

NORTH DAKOTA

Bottineau County: Anschutz Drilling Co. 1 Feland, C NW NW 12-162n-83w. IP 116 BOPD, 154 BWPD, 28°, Mission Canyon 4,084-89 ft. TD 4,089 ft. South Haas pool discovery.

Burke County: Pioneer Oil Co. 1 Bruce Ormiston, C SW SE 25-162n-90w. IP 296 BOPD, 3% water, 38°, Midale 5,946-54 ft. TD 6,072 ft. Lakeview area discovery.

McAlester Fuel-Wilhite-Signal Drilling Co. 1 Alfred Larson, C NW SE 22-163n-90w. IP 91 BOPD, 39°, Nesson 5,600-10 ft. TD 5,675 ft.

OKLAHOMA

Beaver County: Republic Natural Gas Co. 3 Nelson, C SW NE 28-3n-27eCM. IP 1,985 M.c.f. of gas per day, 11 BOPD, Morrow 7,410-28 ft. TD 7,768 ft. New pay in unnamed field.

Panhandle Eastern Pipe Line Co. 1 N. W. Dick, C NW NW 31-5n-21eCM. IP 1,200 M.c.f. of gas per day, Chester 6,512 to 6,545 ft. TD 6,950 ft. New field.

Coal County: International Oil Corp. 1 Crane, SE SW NE 19-2n-9e. IP 4,160 M.c.f. of gas per day, Manning 8,200-10 ft. TD 8,502 ft.

Kingfisher County: Calvert Drilling Co. 1 Grummer, C NE 19-15n-7w. IP 13,164 M.c.f. of gas per day, Manning 8,200-10 ft. TD 8,502 ft.

Kiowa County: L. T. Green, Jr. 1 Neff, SW SW NE SW 4-6n-17w. IP 10 BOPD, 36.5°, 2 to 3 bbl. water. Lime 1,001-11 ft. TD 1,084 ft.

Texas County: Republic 3 Julian, 3-5n-13eCM. IP 10,400 M.c.f. of gas per day, Cherokee 5,640-56 ft., Morrow 6,325-38 ft. TD 6,825 ft.

Petroleum, Inc. 1 Lulu Neese, 22-5n-11eCM. IP 125 BOPD, 35.2°, Morrow 5,636-5,838 ft. TD 3,995 ft. New field.

SOUTHWEST TEXAS

Brooks County: Texkan Oil Co. and Caracas Petroleum, Inc., 1 Dr. Jose Garcia. Share 1-A, La Mestena Salinas-Rafael Garcia Grant (12 miles west of Rachal). Absolute open-flow potential 6,000 M.c.f. daily, GLR 81.23 M.c.f. per bbl., 63°, shut-in TP 2,100 psi., perforations 5,656-66 ft. (Frio). TD 5,903 ft. (New reservoir and extension Alta Mesa field.)

Starr County: Flourney Drilling Co. 1 Arcadio Guerra, Share 3, La Sal Colorado Grant (½ mile northeast of Santa Elena). IP 122.40 BOPD, 3/16-in., 46°, GOR 645 cu. ft. per bbl., TP 320 psi., perforations 5,624-28 ft. (Frio). TD 5,707 ft. (New pay in North Sun area.)

V. F. Neuhaus 1 Nimmo Unit, El Panal Grant (22 miles northeast of Rio Grande City). Absolute open-flow potential 8,400 M.c.f. daily, GLR 54.3 M.c.f. per bbl., 52.9°, shut-in TP 5,040 psi., perforations 8,905-40 ft. (Vicksburg). TD 9,557 ft. (New pay in Yzaguirre field.)

Wood Brothers & Langham 4 D. L. Garza, Tract 144, Porcion 85 (10 miles northeast of Rio Grande City). IPP 28.87 BOPD, 27°, perforations 2,644-49 ft. (Frio). TD 2,810 ft. (New pay in West Ross field.)

Wood Brothers & Langham 1-B Brock,

FROM THE SOUTHEAST

An over-the-road hauler reports

Estes Express Lines, of Richmond, Va., owns a 1958 Ford C-1000 Extra Heavy Duty Tilt Cab model. This rig is on the job 20 hours a day, piling up ten thousand miles a month.

Robey W. Estes, Vice President and General Manager, calls the performance he's getting from his new Ford Tilt "outstanding."

"The economy of Ford's 477-cubic inch V-8 compares very well with the 450-cubic inch sixes in our fleet," he adds. "The Ford performs better and doesn't use any more gas. We get over 5 miles per gallon, which is pretty good for our gross and our kind of hauling. The Ford also has a lot more power and speed. As one of the drivers told me—that Ford gets down the road mighty easy."

Estes Express's big Ford is a 1958 C-1000 tractor, with a 477-cubic inch V-8 engine. It has a 99-inch wheelbase, a five-speed transmission and a two-speed rear axle ratio of 6.14 / 8.36 to 1. Gross weight runs from 52 to 56,800 lb.

"Ford's Tilt Cab design gives us as much as 1800 pounds more payload than we could get with a conventional tractor. Drivers prefer the Tilt because of its comfort and maneuverability."

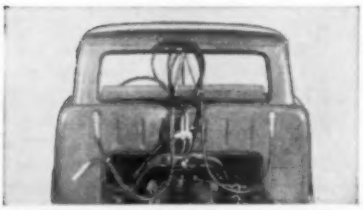
Robey W Estes

Vice President and General Manager
Estes Express Lines

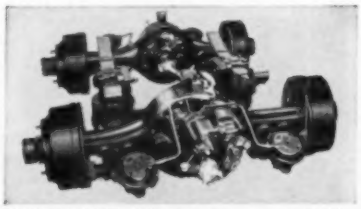
Whatever the job . . . wherever you do it!

There's more to look for in Ford's extra heavies for '59

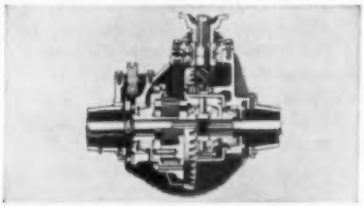
Ford Extra Heavies have proved themselves on every kind of job—you can count on them for *dependability* and *durability*. And in '59, you get high performance at low Ford prices for brand-new reasons! New faster rear axle ratios, new higher capacity axles, and other important options make big-truck operation still thriftier in '59 when you go *Ford*-ward. Send coupon for full information!



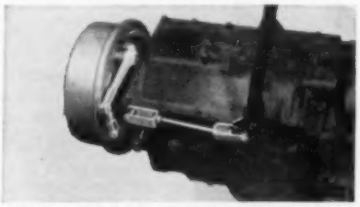
NEW Tractor Equipment Package provides complete trailer air brake and electrical connections, meets I.C.C. requirements.



NEW Ford Tilt Cab Tandems are available with three tandem-axle capacities: 28, 34, and 38,000 lb. Front axles to 15,000 lb.



NEW Faster Axle Ratios team up with Super Duty V-8's for greater gas economy and reduced engine wear. For example, 5.43/7.39 to 1 available in 1100 Series.



NEW 2-Shoe Brake (parking) is standard for '59 on all Ford Extra Heavies. Has 50% greater stopping and holding power, requires 50% less effort to operate.

Tilt Cab Tandem Ford C-950 (above) has hydraulic loader with push-button remote control.

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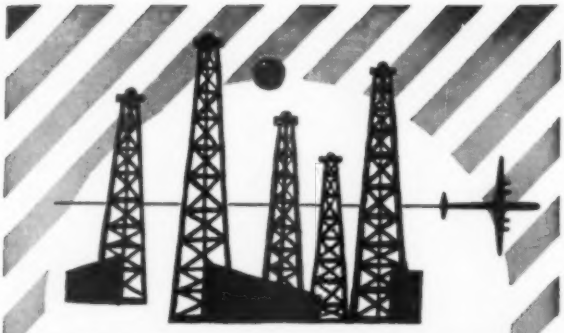
BRAND-NEW TILT CAB TANDEM FORDS for '59 combine the easier, more economical maintenance of tilts with high tandem-axle load capacities. Tilt design also permits higher front axle loads, longer body on given wheelbase. C-950 Tandem, above, operated by Fairlawn Supply and Concrete, Akron, has 15,000-lb. front axle, 34,000-lb. rear. Carries up to 6,500 brick, compared to 5,000 on a conventional tandem. Has 401-cu. in. V-8, 5-spd. main transmission, 3-spd. auxiliary, 201-in. wb. GCW (with pup trailer) 72,000 lb.

COST LESS ... *less to own ... less to run ... last longer, too!*



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LARGEST IN THE SOUTH

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MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Block 49, Goodwin Subd., Porcion 86 (10 miles northeast of Rio Grande City). IPP 63.25 BOPD, 26°, perforations 2,691-96 ft. (Frio). TD 2,722 ft. (New pay in West Ross field.)

Continental Oil Co. 3-A Cameron, Section 137, AB&M Sur., A-60 (29 miles northeast of Rio Grande City). Shut-in gas-condensate well, no gage, perforations 4,163-77 ft. (Frio). TD 10,023 ft. (New pay in East Cameron field.)

Webb County: General Crude Oil Co. 1 Canales et al., Survey 346 (17 miles northwest of Freer). IP 130.42 BOPD, 13/64-in., 40.4°, GOR 314 cu. ft. per bl., TP 130 psi., perforations 5,172-80 ft. (Wilcox). TP 7,515 ft. (New-field discovery.)

Gulf Resources, Inc., 1 Security Delaney Subd., Villa Grant (18 miles NE of Lopena). Shut-in. gas well, no gage (estimated 1,000 M.c.f. daily, ½-in.), perforations 9,436-66 ft. (Wilcox). TD 11,-186 ft. (New field.)

TEXAS GULF COAST

Jefferson County: Shell Oil Co. 33 McFaddin Trust, T&NO Sur., 341, A-282 (12 miles west of Sabine Pass). IP 110 BOPD, 3/32-in., 26°, GOR 327 cu. ft. per bbl., TP 600 psi., perforations 4,612-30 ft. (Miocene), and (dual completion) 103 BOPD, 7/64-in., 25°, GOR 147 cu. ft. per bbl., 500 psi., performations 4,436-44 ft. (Miocene). TD 6,602 ft. (New pays in Clam Lake field.)

WEST CENTRAL TEXAS

Stonewall County: Edwin L. Cox et al. 1 W. I. Martin, Sec. 10, Blk. U, T&P Sur., 10 miles southwest Aspermont, originally completed as Ellenburger discovery of southwest Frankirk field. Reef potential, pumping, 65 BOPD, 37° gravity, GOR 221, pay 5,141-56 ft. TD 6,026 ft.

WEST TEXAS

Glasscock County: Tidewater Oil Co. 1 Couey, 13-36-T5S-T&P, 17 miles southwest Garden City, gas discovery in Spraberry Trend field. IP, calculated open-flow, 1,150 M.c.f. gas, GLR 163,000:1, Devonian perfs. 10,860-10,940 ft. Old TD 11,300 ft.

King County: Pan American Petroleum Corp. 13 Masterson, Sec. 152, Blk. A., W. J. Montgomery Sur., 16 miles northeast Guthrie. IP, calculated open-flow, 7 M.c.f. gas, Mazda-Findley pay 5,275-5,350 ft. TD 6,260 ft.

Griggs Oil Corp. 1-B Parramore "B," 94-F-H&TC, 12 miles southeast Guthrie, upper Tannehill discovery in Block F field. IP 420 BOPD, 24/64-in., 38° gravity, GOR 175, TP 65 psi., pay 3,137-44 ft. TD 3,210 ft.

Schleicher County: Tucker Drilling Co. and L. E. Scherck 1 Derrick, Sec. 40, Blk. A, A-1041, 3 miles southwest Tillery field. Dual completion. IP 1,090 M.c.f. gas, Strawn reef 4,566-76 ft.; IP 3,980 M.c.f. gas, Cayon 4,305-09 ft. TD 4,670 ft.

WYOMING

Sublette County: The Texas Co. 1 Government, 21-27n-113w. IP 748 M.c.f. of gas per day, Second Frontier 6,915-41 ft., 6,613-89 ft., 6,542-70 ft.; First Frontier 6,101-37 ft. TD 8,100 ft. Bridger basin area discovery.

General Petroleum 22-24 Unit, SE NW NW 24-27n-114w. IP 3,400 M.c.f. of gas per day, Second Frontier 6,766-6,805 ft., 6,862-86 ft., 6,591-6,604 ft., 6,606-25 ft., 6,632-36 ft. TD 9,433 ft. Gas discovery in Overthrust belt.

Fabricated Structural Steel and Fabricated Reinforcing Steel for Bridges, Commercial and Industrial Buildings: Schools, Hospitals, Power Plants, Coal Washing Plants.

Galvanized Structural Steel for Electrical Transmission Towers and Substations.

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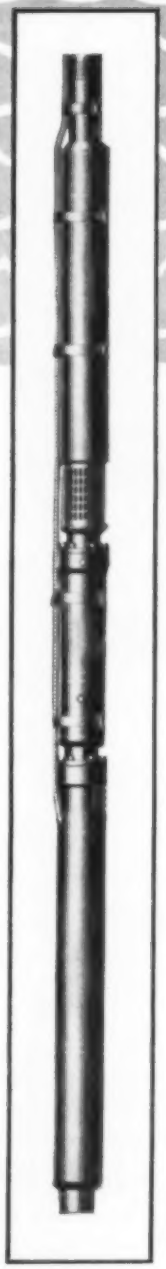

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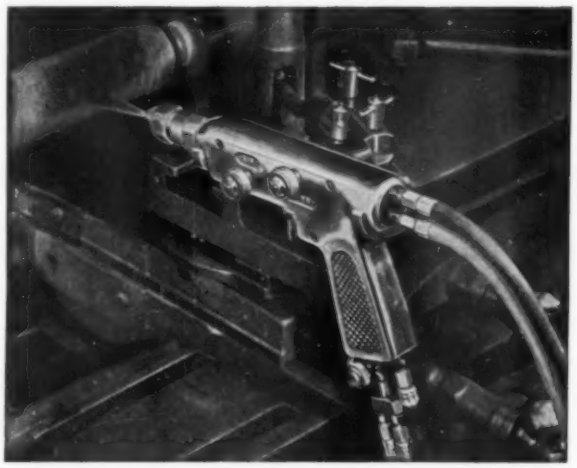
STOP CORROSION

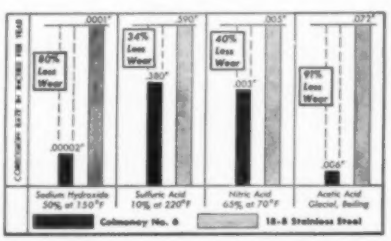


with Colmonoy Spraywelding

The superior corrosion resistance of Colmonoy No. 6 alloy makes it the ideal hard-facing material for use on surfaces undergoing metal-to-metal wear under corrosive conditions, such as pump and valve parts.

The Colmonoy Spraywelder puts No. 6 on fast, in powder form. It makes smooth overlays within .010" of desired size, requiring a minimum of finishing. Sprayweld overlays are solid and welded to the base metal.

The corrosion of vital process equipment parts becomes needless waste when the wear resistant qualities of Colmonoy No. 6 are combined with the economy and ease of the Spraywelder.



This table shows the comparative resistance to corrosion of Colmonoy No. 6 and 18-8 stainless steel. No. 6 is resistant to almost all caustics and acids. Ask for Engineering Data Sheet No. 3.

WRITE RIGHT NOW
For the Colmonoy Spraywelder Catalog and Hard-Facing Manual No. 79

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Aggressive President Chosen

by drilling contractors. Delta Drilling's Joe Zeppa heads company which has reputation for successful pioneering.

THE AMERICAN Association of Oilwell Drilling Contractors can thank the Army for its new president-elect.

For if Joe Zeppa, president of Delta Drilling Co., Tyler, hadn't enlisted in 1917, he would never have become an oil man.

It just so happened that the commanding officer of Sergeant Zeppa's company of engineers, one of the first units in France in World War I, was in the oil business. They became fast friends. And the captain persuaded Zeppa to throw in with him after the war.

In the nearly 40 years since, Zeppa has successfully moved through a wide variety of oil assignments, each more important than the one before, to his present position as head of a 65-rig contracting organization, the second biggest in the world.

Zeppa's success in oil might well have been predicted, based on his prewar accomplishments as a youngster in New York City. He was born at Fubine, Italy, in 1893 and immigrated with an older brother to the U. S. in 1906.

While attending elementary school in New York, Zeppa finished four grades in 2 years with honors. But a family financial pinch forced him to suspend his education on completing the eighth grade. He started work in 1909 as a $3-a-week office boy in the Wall Street offices of the legal firm, Shearman & Sterling. Eight years later, when he volunteered for military service, he had worked up to cashier of that company.

By attending night classes during these 8 years, Zeppa also put himself through high school and took accounting and business administration courses at Pace Institute and at New York University.

Mission to Italy . . . Zeppa was discharged in August 1919 and shortly after left for Italy, on the urging of his exC.O., to take on his first oil chore, a big one, for a joint U. S.-British syndicate.

This syndicate, desperate for a market for its oil production in Mexico, then selling for only 10 cents a barrel, hired Zeppa as part of a mission to persuade the Italian Government to sign a contract calling for converting all railroads running north from Rome from coal to oil fuel. The mission nearly succeeded. Syndicate hopes, however, were suddenly dashed by a shift of political power and a subsequent heavy devaluation of the lira.

Joe Zeppa
. . . army started oil career.

From Rome to Eldorado . . . Meanwhile, Zeppa's U. S. oil employers had acquired leases in Kansas' booming Eldorado field. And he returned to the States to take charge of their Eldorado office in 1921. From this point on he moved up fast.

In 1922, he joined Eldorado Natural Gas Co. as secretary-treasurer, a company later to become Natural Gas & Fuel Corp. This firm was merged in 1928 into what eventually became Arkansas Natural Gas Co., a Cities Service subsidiary. Zeppa and Dave W. Harris, now board chairman of Universal Oil Products Co., directed the merger and set up the new company organization.

In January 1929, Zeppa resigned to accept a job as vice president in charge of marketing for MacMillan Petroleum Corp., Los Angeles. And in 1931, he left this job to start out on his own in East Texas during the famed East Texas field boom.

This was during the depression, and, Zeppa says, "everyone I knew, including myself, was broke." With two other independents, two small second-hand rigs, and credit from supply companies, Zeppa formed Delta Drilling Co.

"Our objective then was to use the rigs as a means to acquire production by drilling for oil payments and overrides. Later on the emphasis was shifted more to drilling itself, but we have always kept our interest in production," he says.

One of the Delta partners, Bob Stacey, sold out in 1938 and Zeppa acquired more than 60% ownership. The Zeppa-Delta story since has been one of steady expansion. The company and its subsidiaries now operate in the Rockies, Texas, New Mexico, Louisiana, Arkansas, Mississippi, in the Gulf of Mexico, the Appalachian area, Venezuela, Italy, and Sicily.

Not afraid to pioneer . . . Delta generally is among the first to employ new drilling techniques.

Delta, for instance, was the first contractor to use the rotary for development in Pennsylvania. This reputedly, just couldn't be done at a profit in competition with cable tools. Delta stepped in where cable tools were completing 7,000 to 8,000-ft. wells in 4 to 6 months and completed its first well using mud in 45 days. Not satisfied with this, it switched to air and cut drilling time to 20 days.

Carrying on the pioneering, the company now is trying something still newer in the area with spectacular results — turbodrilling with air. This is the first time this has been attempted anywhere.

The outlook . . . As president of AAODC, Zeppa likely will prove just as aggressive. He has been a member of the association and of its board since it was formed 18 years ago.

Zeppa feels his work is cut out for him as president next year. He sees no great improvement in the contracting business for the next 2 years due to the volume of oil capital going abroad, low allowables, lack of big discoveries in the U. S., and the tendency to wider well spacing.

The contractor, he thinks, will enter a much brighter era in about 2 years. Then, he says, efficient workable rigs will have been reduced to a number in balance with drilling demand.

●

Serving with President Joe Zeppa (see above) as 1959 officers of the American Association of Oilwell Drilling Contractors will be: **George P. Livermore,** Livermore Drilling Co., Lubbock, Tex., national vice president; **Ray Wiley,** Ray Wiley Drilling Co., Carmi, Ill., vice president for cable tools; **H. Den Johnson,** Carl B.

▶ ▶ ▶ Personals

King Drilling Co., Midland, Tex., vice president for West Texas and New Mexico; **Morris McDannald,** Mac Drilling Co., Houston, vice president for Gulf Coast; **Frank G. McClintock,** Zephyr Drilling Corp., Tulsa, vice president for Central Mid-Continent; **F. M. Stevenson,** Signal Drilling Co., Denver, vice president for Rocky Mountains; **William D. Tetsch,** Terminal Drilling & Production Co., Los Angeles, vice president for California; **Don Slape,** Don Slape Drilling Co., Olney, Ill., vice president for Illinois, Michigan, Indiana, and Kentucky; **A. Earl White,** Mustang Drilling Corp., Tyler, Tex., vice president for cretaceous and tertiary basins; **E. F. Fullen,** Mallard Well Service, Lafayette, La., vice president for well servicing; **M. G. Rowe,** Rowan Drilling Co., Inc., Fort Worth, vice president for North and West Central Texas; **W. W. Hawkins,** Win Hawkins Drilling Co., Lafayette, La., vice president for offshore; and **W. L. McClusky,** M. J. Delaney Co., Dallas, secretary-treasurer.

Brad Mills, executive vice president of the American Association of Oilwell Contractors since the association was formed 18 years ago, has resigned that post effective January 1, 1959, or as soon thereafter as a successor can be chosen. Mills chose to take early retirement. He will remain with the association, however, in an active advisory capacity. Since early 1941 when he started with the association, Mills has headed the AAODC permanent staff at the Dallas headquarters. Membership in 1941 of an original 10 firms has ballooned to more than 950 during Mills' tenure. Nineteen regional chapters have been formed in all principal drilling centers.

Harry F. Swannack has been named Michigan area production superintendent for Gulf Oil Corp. He succeeds **Harold H. Wright,** who has retired. Swannack was formerly in Evansville, Ind., for Gulf.

R. A. McKnight has been appointed superintendent of Phillips Petroleum Co.'s new combined Odessa, Tex., district, which includes the former West Texas and Odessa production districts. McKnight was superintendent of the old Odessa district. **A. W. Mallow,** formerly superintendent of the West Texas district, has become district superintendent at Big Spring, Tex. He succeeds **C. M. Boles,** now superintendent of the Four Corners production district, Cortez, Colo.

John E. Roth, administrative vice president in charge of coordinating domestic and foreign exploration and production activities for Tidewater Oil Co., has been elected senior vice president and a director of the company. He succeeds the late Lloyd F. Bayer. Roth joined Tidal Oil Co., predecessor of Tidewater, in 1924. He served the company in Tulsa as vice president in charge of production and general manager of the central division before becoming administrative vice president in San Francisco in 1956.

David C. Pontius, Shell Oil Co. production geologist in Ventura, Calif., has been transferred to Shell Development Co. as production geologist in Houston.

Charles E. Powell, superintendent of Cities Service Oil Co.'s Pampa, Tex., gasoline plant, has been promoted to assistant superintendent of gasoline-plant operations in charge of the company's District 1. This includes gasoline plants in Burrton and Wichita, Kans., and Blackwell and Guymon, Okla., and an underground storage terminal in Hutchinson, Kans. Powell will headquarter in Wichita. He succeeds the late D. G. Thoes. **Ed B. Lord,** superintendent of the West Seminole plant in Gaines County, Texas, will succeed Powell in Pampa. **Ben W. Montgomery,** superintendent of the East Chico plant, Wise County, Texas, will replace Lord. **Ed Wrangle,** superintendent of the nearby Chico plant, will take on additional duties as superintendent of East Chico, replacing Montgomery. In other changes, **William J. Templeton** has been transferred from West Seminole to Bartlesville, Okla., as production engineer. **Duane W. Bellinger** has been assigned to gas contracts. **Wayne A. Fling,** Chico plant production superintendent, has been transferred to Bartlesville to set up the division's computer section there. **Robert T. Halladay,** plant engineer at the Roberts Ranch plant, Midland County, Texas, will replace Fling. **McCarter A. Roberts,** plant engineer at Pampa, has been promoted to production superintendent at East Chico. **Lyle D. Ochs,** plant engineer, has been transferred to Pampa from Chico. New plant engineers are **Wendell B. Harris,** Roberts Ranch plant, and **James A. Ticer,** Stonewall County, Texas, plant.

Edwin K. Lucas, formerly with Gulf Oil Corp., has joined the geological staff of Fain-Porter Drilling Corp.

Melvin E. Crist, chief chemist for Continental Oil Co. in Chicago, has been transferred to Gretna, La., as manufacturing chemist.

G. L. Porter, senior petroleum engineer with Humble Oil & Refining Co., has been transferred to Andrews, Tex., from Midland, Tex.

Dr. K. A. Smith, formerly head of the light oils division for Sinclair Research Laboratories, Inc., Harvey, Ill., has been named head of the process division there. **M. R. Fairlie,** formerly in charge of lubricants, will head the new products division. **M. P. Kleinholz** and **M. L. Hamilton** have

SMITH

FAIRLIE

been named assistant directors of the products division. **Dr. R. A. Sanford** will be assistant process division director. Both divisions are new. The products division consolidates the lubricants, engine laboratories, light oils, and research divisions. Process division absorbs activities of the research, development, experimental, and refinery application divisions.

J. Theodore Wolfe, president of Baltimore Gas & Electric Co., has been elected president of American Gas Association. He succeeds **Robert W. Otto,** chairman of Laclede Gas Co., who becomes an AGA director. Other officers include **Wister H. Ligon,** Nashville Gas Co., first vice president; **Lester T. Potter,** Lone Star Gas Co., second vice president; and **Vincent T. Miles,** Long Island Lighting Co., treasurer. Newly elected directors are **Eskil I. Bjork,** Peoples Gas Light & Coke Co.; **H. Donald Borger,** Peoples Natural Gas Co.; **William G. Hamilton, Jr.,** American Meter Co.; **W. J. Harvey,** Public Service Electric & Gas Co., Newark, N. J.; **Andrew W. Johnston,** Boston Gas Co.; **E. Clyde McGraw,** Transcontinental Gas Pipe Line Corp.; **Edward A. Norman,** Norman Products Co., Columbus, Ohio; and **Gustav F. Watters,** Niagara Mohawk Power Corp.

▶▶▶ Personals

LANG

Joseph H. Lang, assistant vice president and assistant manager of transmission for Ohio Fuel Gas Co., has moved up to manager of the transmission department. He succeeds **Clyde C. Phillips,** who retired October 1 (OGJ, Sept. 29, p. 130). In other changes, **Alvin M. Hutchison,** superintendent of gas measurement, becomes assistant manager of transmission. **Michael P. Debaets,** assistant superintendent of gas measurement, succeeds Hutchison as manager.

J. H. Ransom, senior geophysicist in Sinclair Oil & Gas Co.'s Tulsa division, has been promoted to Albuquerque district geophysicist.

Dr. John R. Thomas, research associate for California Research Corp., has been promoted to senior research associate. He will be responsible for fundamental physical chemistry research in the petroleum products division. Also, **Glenn W. Billman** has been named supervising research engineer at the company's Richmond, Calif., laboratory.

Recipients of the Cedric K. Ferguson Medal at last week's Houston meeting of Society of Petroleum Engineers of AIME were **Jim Douglas, Jr.,** Rice Institute faculty member; **P. M. Blair,** Humble Oil & Refining Co.; and **R. J. Wagner,** Ramo-Wooldridge Corp., Los Angeles. The medal is presented to the author of the best technical paper of the year by a young AIME member. The three combined to write the winning paper.

James I. Harper, assistant superintendent of petrochemicals at Sun Oil Co.'s Marcus Hook, Pa., refinery, has been named president of SunOlin Chemical Co. SunOlin, newly formed petrochemical company, is a subsidiary of Sun and Olin Mathieson Chemical Corp. **S. S. Johnson** of Olin Mathieson is vice president of SunOlin. Other officers are **J. R. Sanderford,** Olin Mathieson, secretary and assistant treasurer; **Joseph T. Wilson, Jr.,** Sun, treasurer and assistant secretary; and **Joseph R. Layton,** Sun, comptroller. Directors appointed by the parent companies are **Donald W. Drummond, John O. Logan, William B. Copeland,** and Johnson, from Olin Mathieson; and **Clarence H. Thayer, Chalmer G. Kirkbride,** Wilson, and Harper, from Sun.

Allen J. Stroud, formerly with Republic Oil Refinery Co., has joined Monsanto Chemical Co.'s plastics division in Texas City, Tex.

Charles E. Morgenthaler, senior engineer with Carter Oil Co., has been transferred to St. Elmo, Ill., from Great Bend, Kans.

C. E. Headington has been named manager of Atlantic Refining Co.'s basic research division. **W. K. Griesinger** has been appointed manager of the application research division.

Dwayne E. Godsey, petroleum engineer in Casper, Wyo., for Tennessee Gas Transmission Co., has been transferred to Houston in the same capacity.

J. F. Dyer has resigned as Rocky Mountain exploration manager for Anderson-Prichard Oil Corp. to join Apache Oil Co. as Tulsa division manager. **John H. Brunel** will succeed Dyer with Anderson-Prichard.

Bruce Jones, products coordinator for LaGloria Oil & Gas Co., has been named manager of supply and distribution. Jones was assistant to the president of McMurrey Refining Co. before it was bought by LaGloria in 1957. LaGloria is a subsidiary of Texas Eastern Transmission Corp.

A. F. Seidel, superintendent of Sunray Mid-Continent Oil Co.'s Carney plant, Wellston, Okla., has been transferred to Moore, Okla., as plant superintendent. **T. G. Merritt,** Moore superintendent, will succeed Seidel at Carney. In other changes **W. D. Morrison,** repairman at the North West Branch, La., plant, has been named operating foreman at Moore. **J. A. Nicholson,** formerly at Moore, has been named operating foreman at the South Sarepta, La., plant. Also named operating foremen are **G. R. Ethridge,** who moves from the Red Fish Bay plant, near Ingleside, Tex., to North West Branch; **Larry Hooker,** who moves from North West Branch to the DeQuincey, La., plant; and **William Bridges,** formerly gas tester in the Corpus Christi, Tex., area, now operating foreman at Red Fish Bay. **D. G. Bower,** formerly in Snyder, Tex., has become gas tester in the North and West Texas district, Placedo area. **Mac H. Smith,** Sarepta, transfers to Midland, Tex., as gas tester in the North and West Texas district office. **Ward Love** has been moved from the Placedo area to the Corpus Christi area as gas tester.

Dr. John E. Kircher, general manager of Continental Oil Co.'s petrochemical department, has been promoted to executive assistant to the senior vice president. He will continue to headquarter in Houston. **E. B. Baker,** manager of the company's research and development department, will succeed Kircher as head of the petrochem department. Baker will move to Houston from Ponca City, Okla. **Dr. M. L. Sharrah,** director of the petrochemical research division,

KIRCHER

BAKER

will move up to succeed Baker as manager of research and development. He will headquarter in Ponca City. **Dr. Warren L. Jensen,** director of the petroleum products division, has been named to succeed Sharrah as petrochemical research director. **Warren W. Woods,** supervising research chemist, will succeed Jensen. In Houston, **James G. Hough,** assistant general manager of the petrochemical department, has been promoted to manager of the department's chemicals division. **W. B. Strobel,** formerly manager of the chemicals division, has been named development engineer assigned to study new business opportunities.

F. L. Lively, assistant district superintendent for Humble Oil & Refining Co. at Crowley, La., has been transferred to Laurel, Miss., in the same capacity.

Among those receiving awards of merit from the American Gas Association's operating section at AGA's annual meeting in Atlantic City, N. J., are **Alvan V. Brashear,** Michigan Consolidated; **A. L. Bristow,** Northern Natural Gas Co.; **Thomas B. Kelley,** Texas Eastern Transmission Corp.; **N. A. Manfred,** Chicago District Pipeline Co.; **Elmer O. Mattocks,** American Petroleum Institute; **Dr. C. Gordon Milbourne,** United Engineers & Constructors, Inc.; **Pat H. Miller,** Texas Eastern; **David C. Palm,** Natural Gas Pipeline Co. of America; **Charles U. Pittman,** Koppers Co., Inc.; **Charles E. Terrell,** Southern Natural Gas Co.; and **Chester E. Upson,** Natural Gas Pipeline.

Personals

L. Russell Marks, vice president of Murphy Corp., has been advanced to executive vice president. **J. A. O'Conner, Jr.,** has been elected vice president.

Frank D. Stockman has been appointed manager of the reserves and availability division of Northern Natural Gas Co. **Vincent E. Martinson** has been named underground storage division manager. Stockman has been with Northern since 1956. Martinson since 1949.

E. J. Dunigan, Jr., Radcliffe Killam, and **John W. Mecom** were elected vice presidents of the Texas Mid-Continent Oil and Gas Association at the group's annual meeting last week in Dallas. Dunigan, of Pampa, will represent the Panhandle district; Killam, of Laredo, the lower Gulf Coast district; and Mecom, of Houston, the middle Gulf Coast district. Other association officers were reelected.

S. P. Kent, former superintendent of drilling and production for Texaco Exploration Co., has been named vice president and operations manager for Paria Operations, Inc. He succeeds **B. F. Wright,** who has resigned to become a consultant in Colombia. Paria Operations is owned jointly by Continental Oil, Texaco, Cities Service, and Richfield Oil.

Ralph P. Latimer, administrative assistant to the president of Lion Oil Co. division of Monsanto Chemical Co., has been named assistant to the manager of production and exploration for Lion. He will headquarter in Houston. Monsanto has named **Paul Logue,** assistant director of development in the inorganic chemicals division, manager of market research in the St. Louis research and engineering division's development department. Also, **Robert R. Osburn,** senior engineer in the Texas City plastics plant, has been named chief planner and coordinator in the planning and scheduling section of the maintenance department there.

ADAMS

J. B. Adams, refinery manager for U. S. Oil & Refining Co., Tacoma, Wash., has been elected vice president and manager of manufacturing. **G. S. Peterson,** chief engineer, has been appointed superintendent of operations. **F. W. Brugman,** assistant engineer, will succeed Peterson as chief engineer.

Richard G. Boyd, formerly manager of the Casper, Wyo., office of Alex McCoy & Associates, has joined True Oil Co., Casper, as staff geologist.

Bruce Denny, superintendent of Sunray Mid-Continent Oil Co.'s West Texas-New Mexico gas district, has been transferred to Midland, Tex., from Snyder, Tex. Headquarters of the district, now called the North and West Texas gas district, will be permanently located in Midland.

Deaths

Walter W. Scheumann, 57, vice president and general manager of Cities Service Research & Development Co., died October 5 at his home in Cranford, N. J. Scheumann was chief chemist for Empire Oil & Refining Co. at Okmulgee, Okla., and manager of Cities Service research at Lake Charles, La., at one time.

John Long, engineer with Chicago Bridge & Iron Co., died in Maracaibo, Venezuela, from injuries received in the explosion of a tank being built by San Jacinto Petroleum Corp. **Marshall Johnson,** also with Chicago Bridge, died later from injuries in the same accident.

Fred M. Vance, 83, pioneer oil operator, died recently in Long Beach, Calif. He was the father of **Harold Vance,** vice president and manager of the oil and gas department of the Bank of the Southwest. The elder Vance was with Union Oil Co. at one time.

Jack R. McNutt, president of Service & Supply Co., El Paso, Tex., was killed in an automobile accident September 29 in El Paso. Before forming Service & Supply, McNutt was secretary of McNutt Oil & Refining Co., a family enterprise operated by six McNutt brothers. The company was sold to El Paso Natural Gas Products Co. in 1955. Several of the McNutt brothers are now with El Paso.

Dr. Oscar E. Bransky, 72, retired assistant general manager of manufacturing for Standard Oil Co. (Ind.), died October 1 at Palm Beach, Fla. Bransky joined Indiana Standard in 1910 as a research chemist at Whiting, Ind. He later was manager of the Whiting refinery. After retirement from the company in 1948 he became a consultant for the Economic Cooperation Administration and in 1950 was appointed chief of the petroleum branch of the Marshall Plan.

James Roy Pringle, 75, retired Tulsa independent, died October 6 in Pittsburgh while visiting relatives.

Arthur V. Chandler, 81, retired chief gauger at the old Mid-Continent Petroleum Corp.'s Tulsa refinery, died October 3 in Tulsa. Chandler retired in 1946.

Henderson Coquat, 65, president of Longhorn Drilling Corp. and a South Texas independent producer, died September 29 in a San Antonio hospital. Coquat was active in the early development of Three Rivers field and owned production throughout South Texas.

William F. Buckley, 77, independent operator of Camden, S. C., and Sharon, Conn., died October 5 in New York. Buckley organized many companies during his oil career, which began 45 years ago. He was active in Venezuela through his Pantepec Oil Co. of Venezuela, formed in 1924, and Pancoastal Oil Co., organized in 1948 to hold concessions in Venezuela and Florida. In 1953, he formed Pan-Israel Oil Co., Inc., and Israel-Mediterranean Petroleum, Inc. Two years ago he organized San Jose Petroleum, Inc., to explore concessions in the Philippines.

C. S. Ehret, Gifford, Pa., retired oil producer, died September 27 in Bradford, Pa.

J. J. Young, president of J. J. Young Oil Drilling Co., Ponca City, Okla., died October 6 in Columbus, Ohio. He and his wife were en route to Ponca City from Washington, D. C., at the time. Young was one of the organizers of the old Jens-Marie Oil Co. in Ponca City.

T. Blake Dirickson, 70, Tulsa independent operator, died October 4 at his home after a heart attack. Dirickson entered the oil business in 1916. He was active in the old Seminole field and developed oil properties in Kansas, Illinois, and Oklahoma.

Oil demand up; GNP down this year

. . . but curves may have closer fit in the future

BY JOHN C. CASPER

DEMAND FOR PETROLEUM products has grown at a faster rate than gross national product in past years, particularly since the end of World War 2. Reasons for the faster relative expansion have been:

. . . **Wartime production** raised gross national product to a peak in 1944. Total government purchases of goods in services in 1944 amounted to almost five times the total for 1940. GNP did not reach the 1944 peak again until 1950. All GNP figures have been corrected for inflation by deflators developed by the Department of Commerce.

. . . **Oil demand** was held down by rationing during the war years, and growth was limited by restricted production of durable goods. There was no production of automobiles for civilian use. New homes were heated by coal where possible.

. . . **Part of the gain** in petroleum demand in the postwar period has come through replacement of other fuels, mostly coal. Coal accounted for 55.9% of energy fuel use in 1943 and had dropped to 27.0% of the total for 1957. Oil use represented 27.1% of the total in 1943 and 41.1% in 1957. The big gain was in natural gas with a movement from 11.4% to 25.0% in the same period.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,022,150	DOWN	77,250	UP	131,757
Crude stocks	248,045,000	UP	5,461,000	DOWN	34,318,000
Completions	899	DOWN	41	DOWN	273
Refinery runs	7,507,000	DOWN	132,000	DOWN	272,000
Gasoline stocks	172,482,000	DOWN	999,000	DOWN	4,901,000
Kerosine stocks	31,317,000	UP	375,000	DOWN	4,458,000
Distillate stocks	156,528,000	UP	2,895,000	DOWN	14,763,000
Residual stocks	68,742,000	DOWN	853,000	UP	10,639,000
Four-product stocks	429,069,000	UP	1,418,000	DOWN	13,483,000
Total imports	1,720,700	DOWN	206,100	UP	64,400

The chart shows the relative changes for GNP and domestic demand for petroleum products. The lines indicate percentages of average activity for 1929-30. If 100 is subtracted from the point values, the lines will show percentage gain since the base period.

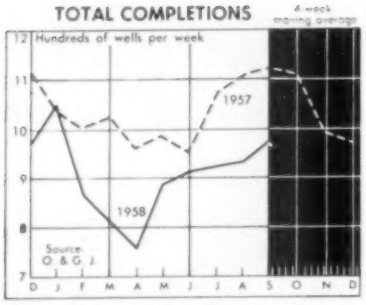
Domestic demand for petroleum products will gain about 2.2% this year, most of which can be credited to cold weather in the first quarter. GNP will be up in the last half but probably not enough to prooduce a gain for the year.

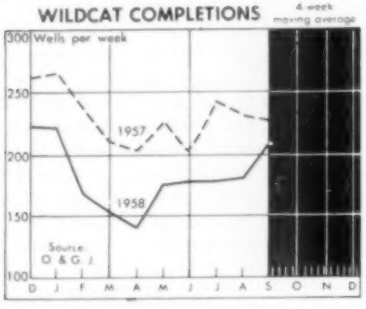
Since oil cannot continue indefinitely to replace other fuels, its rate of gain will be nearer the over-all rate of energy consumption. This shift will bring future gains a little more in line with rises in GNP.

Market changes . . . Soft residual markets are causing reductions in postings for heavy crudes, particularly in Venezuela. Shell Oil Co. of Venezuela cut heavy crudes with the range from 10-25 cents a barrel. Crudes below 15° gravity were cut 25 cents. Light crudes were unchanged.

GROSS NATIONAL PRODUCT, the market value of all goods and services produced in the nation's economy, is almost 2.5 times the total for 1930, even after correction for inflation. Oil demand is 3.5 times the 1930 average.

DRILLING





Active Rotary Rigs*

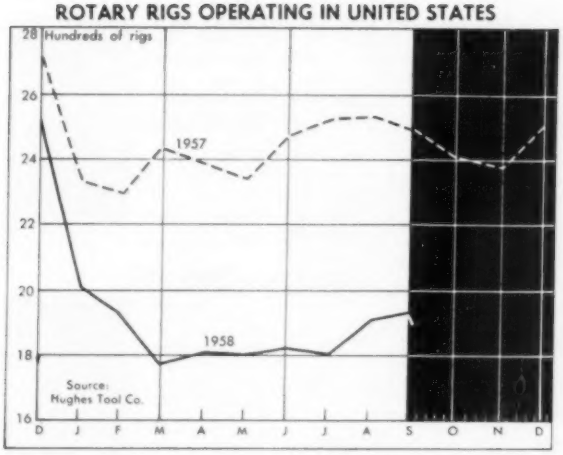
	10-6-58	9-29-58	10-7-57
Alabama	7	7	4
Arkansas	22	25	23
Arizona	1	2	1
California	71	73	95
Colorado	38	41	56
Florida	1	1	1
Georgia	.	.	.
Idaho	.	.	.
Illinois	55	51	61
Indiana	10	10	11
Iowa	3	3	2
Kansas	150	142	161
Kentucky	6	4	10
Louisiana	300	299	436
North	21	27	56
South	237	235	291
Offshore	42	37	89
Maryland	.	.	1
Michigan	8	10	11
Missouri	1	1	.
Montana	23	23	34
Mississippi	49	51	41
Nebraska	24	21	36
Nevada	.	.	.
New Mexico	89	92	141
New York	2	2	.
North Dakota	30	32	36
Ohio	.	.	.
Oklahoma	207	212	257
Oregon	.	.	1
Pennsylvania	9	9	11
South Dakota	3	3	1
Texas	686	670	898
South-Gulf	137	135	196
Offshore	1	1	4
North-East	162	167	(†)
West-Central	226	212	(†)
West	160	155	(†)
Tennessee	.	.	1
Utah	37	31	71
Washington	1	1	1
West Virginia	4	2	3
Wyoming	61	63	83
Virginia	.	.	.
Total U. S.	1,898	1,881	2,488
Western Canada	145	137	190
Eastern Canada	3	4	3
Grand total	2,046	2,022	2,681

*Hughes Tool Co. †Comparisons not available due to changes in method of reporting.

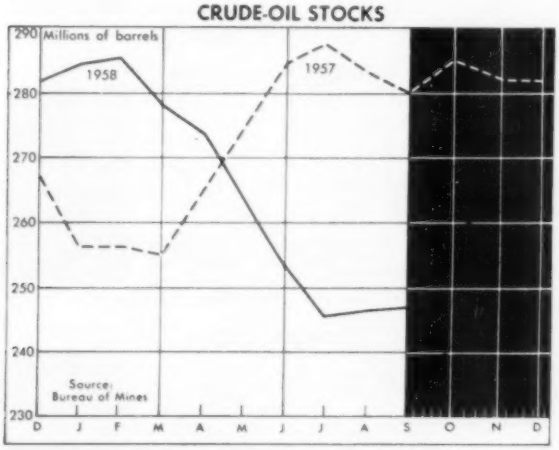
WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 4, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	1	1	0	0	0	0	11,557	59	67	0	0	0	0	0	23	21
Arkansas	7	2	0	0	5	0	23,993	578	853	1	0	0	0	1	122	157
California	15	9	0	1	5	0	77,612	1,175	1,672	3	1	0	0	2	281	403
Colorado	16	3	0	1	12	0	82,384	622	640	9	0	0	0	9	359	422
Illinois	63	29	0	0	34	0	144,701	1,706	1,997	14	3	0	0	11	346	484
Indiana	22	4	0	0	18	0	32,054	600	492	12	1	0	0	11	218	97
Kansas	98	41	0	5	45	7	352,118	2,883	3,188	18	4	0	0	14	605	640
Kentucky	12	1	0	0	10	1	16,895	880	1,134	0	0	0	0	0	114	232
Louisiana	60	25	6	2	27	0	404,284	2,606	2,933	10	1	1	0	8	384	516
North	30	15	0	1	14	0	97,783	976	1,061	6	1	0	0	5	164	140
South	21	6	4	0	11	0	204,919	1,295	1,348	4	0	1	0	3	197	312
Offshore	9	4	2	1	2	0	101,582	335	524	0	0	0	0	0	23	64
Michigan	19	5	0	0	10	4	55,121	323	325	4	0	0	0	4	103	118
Mississippi	5	3	0	0	2	0	45,537	291	298	3	1	0	0	2	136	156
Montana	4	1	0	0	3	0	33,855	253	309	0	0	0	0	0	101	121
Nebraska	19	6	0	0	13	0	112,548	536	676	8	1	0	0	7	251	375
New Mexico	33	11	1	12	9	0	159,173	1,472	1,636	8	2	0	0	6	204	211
West	20	2	1	12	5	0	89,008	714	673	4	0	0	0	4	86	81
East	13	9	0	0	4	0	70,165	758	963	4	2	0	0	2	118	130
New York	9	3	0	1	2	3	14,127	418	353	2	0	0	0	2	39	6
North Dakota	7	4	0	0	3	0	30,753	342	212	2	0	0	0	2	111	96
Ohio	17	10	0	3	4	0	45,909	774	857	0	0	0	0	0	12	10
Oklahoma	105	49	0	7	39	10	352,389	4,852	4,798	13	2	0	0	11	666	559
Pennsylvania	0	0	0	0	0	0	0	438	517	0	0	0	0	0	14	39
Texas	338	180	8	9	133	8	1,378,921	13,614	16,736	68	5	2	0	61	2,797	4,002
Dist. 1	17	6	1	0	10	0	57,316	743	963	6	0	0	0	6	296	325
Dist. 2	12	2	2	2	6	0	78,900	572	582	6	0	1	0	5	155	209
Dist. 3	18	9	1	1	7	0	110,135	968	1,325	2	0	0	0	2	217	374
Dist. 4	21	6	0	3	12	0	123,912	896	1,090	6	0	0	0	6	267	358
East	22	13	1	0	8	0	83,505	943	1,022	5	0	1	0	4	261	295
Dist. 7-B	46	18	0	0	27	1	125,724	1,856	2,251	12	0	0	0	12	522	769
West	104	73	0	1	25	5	474,017	3,914	4,755	15	2	0	0	13	553	678
Dist. 9	72	39	0	2	29	2	179,773	2,740	3,638	9	1	0	0	8	439	910
Dist. 10	26	14	3	0	9	0	145,639	982	1,110	7	2	0	0	5	87	84
Utah	6	5	0	1	0	0	36,533	289	164	0	0	0	0	0	64	83
West Virginia	29	3	0	22	4	0	89,028	564	520	1	0	0	0	1	14	24
Wyoming	14	4	0	1	9	0	71,017	572	647	7	0	0	0	7	172	224
Misc.	0	0	0	0	0	0	0	70	111	0	0	0	0	0	60	94
Total U. S.	**899**	399	15	65	387	33	3,570,509	35,917	41,135	**183**	21	3	0	159	7,196	9,090
Previous week	940	435	23	58	394	30	3,731,350	. . . . .	. . . . .	197	13	3	6	175	. . . . .	. . . . .
Cum. 1958	35,917	17,518	867	2,732	13,847	953	148,351,340	. . . . .	. . . . .	7,196	705	124	201	6,166	. . . . .	. . . . .
Western Canada	52	33	0	6	13	0	266,439	1,863	2,369	12	1	0	1	10	505	666

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	9-27-58	9-20-58	9-28-57
Pennsylvania	2,828	2,842	3,146
Other Appalachian	1,406	1,432	1,812
Illinois, Indiana, Michigan	10,119	10,253	11,676
Nebraska and North Dakota	2,283	2,411	3,046
Kansas	9,350	9,171	10,399
Oklahoma	16,190	15,408	21,771
Arkansas	1,752	1,785	2,530
Louisiana	16,302	15,808	19,428
North	2,821	2,722	3,243
South	13,481	13,086	16,185
Mississippi, Alabama, Florida	2,677	2,635	3,030
New Mexico	7,924	7,987	10,079
Texas	105,627	103,344	126,462
East Texas	7,837	7,603	9,878
West Texas	54,476	50,953	60,068
Texas Gulf	19,322	18,889	24,542
Other Texas	25,992	25,899	31,974
Wyoming	13,562	13,108	15,803
Other Rocky Mountain	9,113	9,147	6,125
California	33,947	34,490	31,627
Foreign	†14,965	12,763	15,429
Total	**248,045**	242,584	282,363

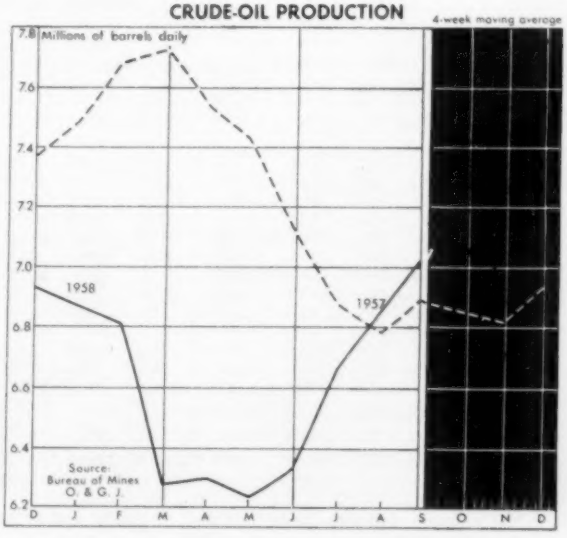
*Bureau of Mines. †Includes 5,514,000 bbl. in California.

DAILY AVERAGE PRODUCTION FOR WEEK

	October 4, 1958 Crude oil	Lease condensate	Total	Sept. 27 total
Alabama	16,225	.....	16,225	14,950
Arkansas	74,575	150	74,725	73,600
California	854,500	.....	854,500	852,600
Colorado	130,900	.....	130,900	131,300
Eastern	46,800	.....	46,800	47,000
Florida	1,225	.....	1,225	1,225
Illinois	230,900	.....	230,900	233,200
Indiana	32,600	.....	32,600	33,000
Kansas	†339,000	.....	†339,000	†336,000
Kentucky	41,400	.....	41,400	41,600
Louisiana	801,775	89,500	891,275	884,650
North	107,500	3,100	110,600	111,200
South	694,275	86,400	780,675	773,450
Michigan	24,200	.....	24,200	22,400
Mississippi	103,825	4,400	108,225	106,700
Montana	77,000	.....	77,000	77,800
Nebraska	57,700	.....	57,700	58,200
Nevada	100	.....	100	100
New Mexico	275,325	6,000	281,325	279,100
North Dakota	18,500	.....	18,500	24,000
Oklahoma	†561,300	.....	†561,300	†569,200
Texas	2,738,275	63,200	2,801,475	2,890,500
Dist. 1	47,575	500	48,075	48,500
Dist. 2	122,850	8,300	131,150	136,300
Dist. 3	360,275	31,000	391,275	405,500
Dist. 4	204,850	7,800	212,650	221,100
Dist. 5	32,725	400	33,125	34,375
Dist. 6	125,725	6,800	132,525	136,100
East Texas field	158,700	.....	158,700	166,000
Dist. 7-B	150,275	50	150,325	155,075
Dist. 7-C	142,000	4,050	146,050	149,050
Dist. 8	1,075,150	2,000	1,077,150	1,117,000
Dist. 9	211,150	1,500	212,650	213,500
Dist. 10	107,000	800	107,800	108,000
Utah	106,700	.....	106,700	96,800
Wyoming	325,900	.....	325,900	325,300
Others	‡175	.....	‡175	‡175
Total U. S.	6,858,900	163,250	**7,022,150**	7,099,400
Change from prev. week, down			**77,250**	.....
Canada	†403,500	.....	†403,500	†458,600
Total U. S. prod.—Jan. 1-Oct. 4				1,821,973,900 bbl.
Same period last year (crude plus cond.)				*2,013,050,701 bbl.

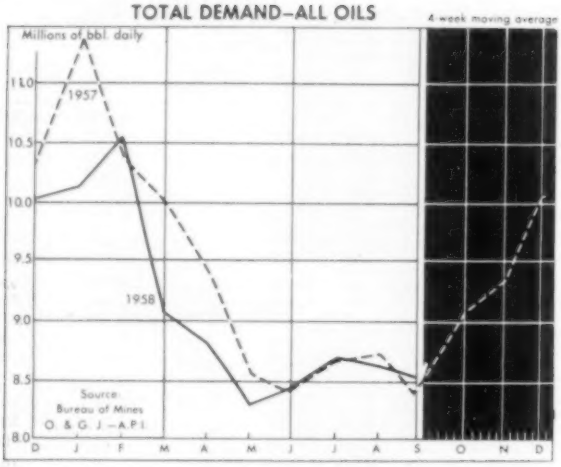
*Includes 38,653,795 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Washington.

CRUDE-OIL PRODUCTION

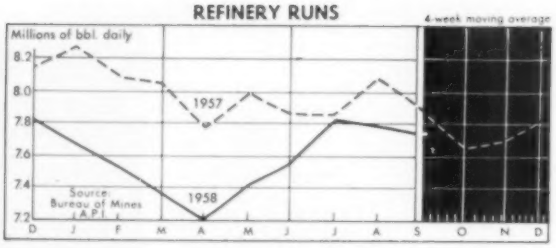


REFINING

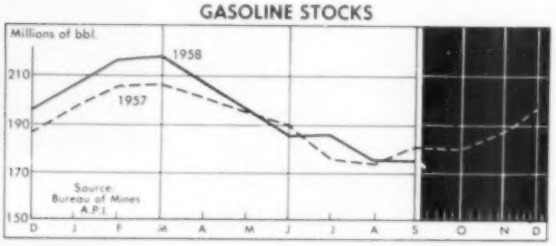
TOTAL DEMAND—ALL OILS



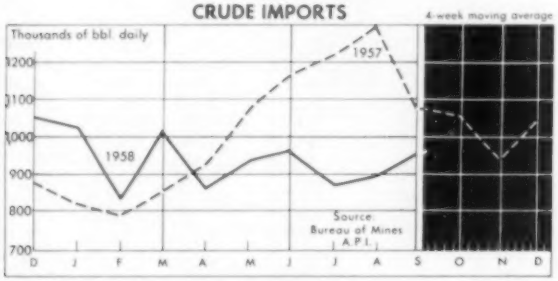
REFINERY RUNS



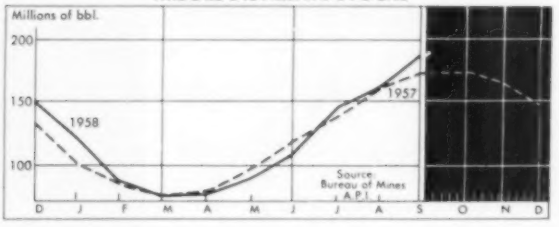
GASOLINE STOCKS



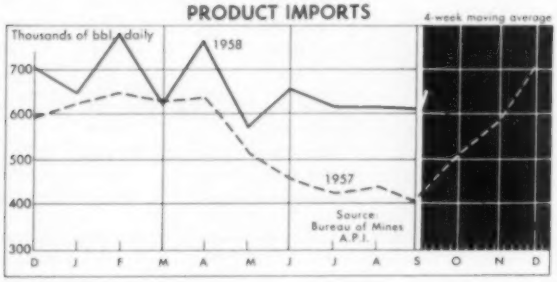
CRUDE IMPORTS



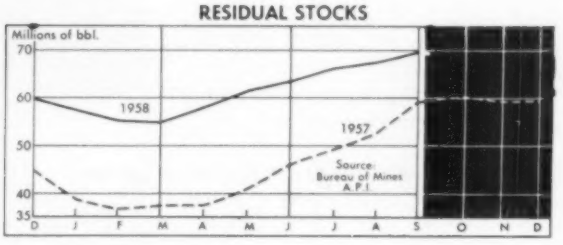
MIDDLE-DISTILLATE STOCKS



PRODUCT IMPORTS



RESIDUAL STOCKS



API REFINERY REPORT, OCTOBER 3, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, October 1957 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,137	506.3	35.1	288.3	210.0	39,667	11,786	55,922	12,909	1,088	487.2	24.5	306.1	166.6
Appalachian:														
District 1	91	45.0	4.0	23.3	6.9	4,700	630	3,671	334	108	46.8	4.6	23.9	8.7
District 2	82	49.1	4.7	23.6	6.9	2,334	532	1,463	179	109	54.8	5.6	17.9	11.5
Ind., Ill., Ky.	1,369	726.6	57.0	290.7	148.7	32,412	7,889	28,222	5,723	1,367	730.5	69.0	275.0	161.3
Minn., Wis., Dak.	56	30.0	1.1	21.4	8.9	6,795	1,409	8,528	538	82	38.9	1.6	22.6	7.2
Okla., Kans., Mo.	697	372.0	8.7	180.7	29.7	16,383	1,946	13,081	1,152	709	396.9	11.8	167.8	30.7
Inland Texas	249	181.6	6.6	50.1	22.1	6,759	361	2,045	2,059	256	206.3	7.6	48.5	26.4
Tex. Gulf Coast	1,732	864.3	64.3	467.0	175.4	21,681	2,999	16,614	8,809	1,792	924.3	97.7	432.3	208.6
La. Gulf Coast	644	352.7	45.6	162.4	29.3	9,775	2,272	7,146	1,661	614	355.5	31.9	164.4	42.2
N. La. and Ark.	98	45.4	5.7	22.9	6.6	4,497	796	2,518	163	85	35.5	5.7	18.8	5.6
Rky. Mountain:														
New Mexico	19	12.6	0.3	3.2	0.9	468	17	121	52	28	15.4	0.5	5.5	3.5
Other Rky. Mt.	273	115.8	9.4	54.1	30.1	4,334	340	3,028	831	261	128.2	3.5	61.8	34.2
West Coast	1,060	479.0	4.6	166.0	291.9	22,677	340	14,099	34,332	1,151	474.8	1.5	160.1	345.2
Oct. 3, 1958	7,507	3,780.4	274.1	1,753.7	958.4	172,482	31,317	156,528	68,742	7,650	3,895.1	265.5	1,705.3	1,051.7
Sept. 26, 1958	7,639	3,965.4	306.1	1,782.1	1,004.9	173,481	30,942	153,633	69,595	.....	.....	.....	.....	.....
Oct. 4, 1957	7,779	3,970.4	235.9	1,757.9	1,094.1	177,383	35,775	171,291	58,103	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.75-12.25
Premium (99 octane)	14.75-15.25
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25
Regular (92 octane)	10.50
Premium (97 octane)	11.625
Premium (98 octane)	11.75
California (rack) (Los Angeles):	
Regular (88 octane)	11.3-11.5
Premium (96 octane)	12.8-13.0
Premium (98 octane)	13.3-13.5
Caribbean area (cargoes):	
Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.75-10.00
Diesel oil (58 d.i. and above)	9.50-9.75
Distillate No. 1	9.50-9.75
Distillate No. 2	8.75-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	8.875
Distillate No. 2	8.625
New York Harbor (barges):	
Kerosine 41-43	9.95
Distillate No. 2	9.45
Diesel fuel, 48-52 d.i.	10.05
Caribbean area (cargoes):	
Distillate No. 2	8.625

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank car	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.40-1.50
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.10

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	★Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.75	....	$2.62	2.06
21-21.9	2.50	2.77	....	2.64	2.11
22-22.9	2.60	2.79	....	2.66	2.16
23-23.9	2.69	2.81	$3.44	2.68	2.21
24-24.9	2.78	2.83	3.46	2.70	2.26
25-25.9	2.87	2.85	3.48	2.72	2.31
26-26.9	2.96	2.87	3.50	2.74	2.36
27-27.9	3.06	2.89	3.52	2.76	2.49
28-28.9	3.11	2.91	3.54	2.78	2.54
29-29.9	3.16	2.93	3.56	2.80	2.59
30-30.9	3.22	2.95	....	2.82	2.63
31-31.9	3.27	2.97	....	2.84	2.67
32-32.9	3.33	2.99	....	2.86	2.71
33-33.9	3.38	3.01	....	2.88	2.75
34-34.9	3.44	3.03	....	2.90	2.79
35-35.9	3.49	3.05	....	2.92	2.83
36-36.9	3.55	3.07	....	2.94	2.87
37-37.9	3.60	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40-44.9	....	3.15	....	3.02	2.95

*Includes Oklahoma (sweet), part of Kansas, North Dakota, West Texas (sweet). Some Oklahoma selling 14-31 cents under this schedule. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 9-30-58; East of California, January 3-10, 1957; Pennsylvania Grade, 6-18-58.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Ville Platte	3.30
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	3.90
Middle District	3.72
Southwest Pennsylvania	3.43
West Virginia	3.25
Buckeye Grade	3.25
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.15
Lagunillas heavy, flat, Amuay or Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.93

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC −10%)	$2.57
★ Carib.-U.S.N.H., clean (ATRS −37.5%)	1.72
★ Carib.-U.S.N.H., dirty (USMC −45%)	1.49
★ Carib.-France, dirty (Scale−55%) (14s. 8d.)	2.05
★ P.G.-U.S.N.H., dirty (USMC −52.5%)	6.03

SELECTED MONTHLY DATA

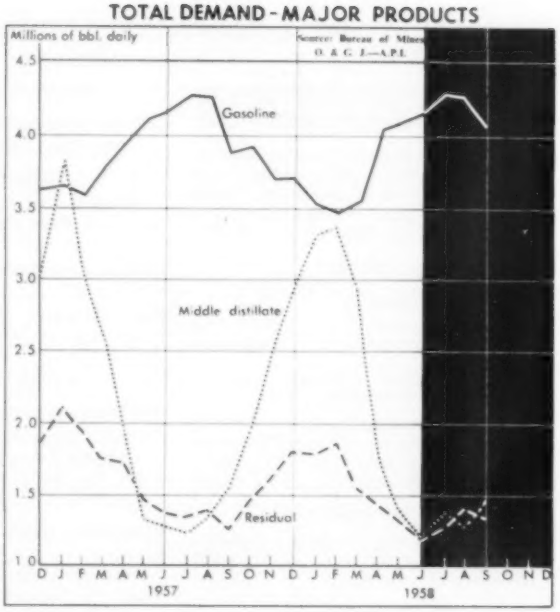
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

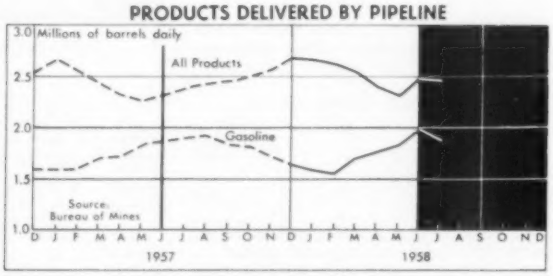
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
September 1958*	4,060	3,960	172,800
August 1958*	4,260	3,980	173,000
July 1958	4,299	4,017	180,705
October 1957	3,937	3,895	180,902
September 1957	3,897	4,062	180,688
KEROSINE			
September 1958*	200	280	31,200
August 1958*	165	260	28,900
July 1958	180	225	25,655
October 1957	334	266	34,384
September 1957	220	276	36,382
DISTILLATE			
September 1958*	1,280	1,770	155,700
August 1958*	1,120	1,690	140,000
July 1958	1,231	1,650	119,437
October 1957	1,622	1,705	176,388
September 1957	1,334	1,772	173,269
RESIDUAL			
September 1958*	1,340	985	69,000
August 1958*	1,410	985	67,100
July 1958	1,254	981	66,457
October 1957	1,471	1,052	60,025
September 1957	1,269	1,100	58,727

*Preliminary. †Thousands of barrels.

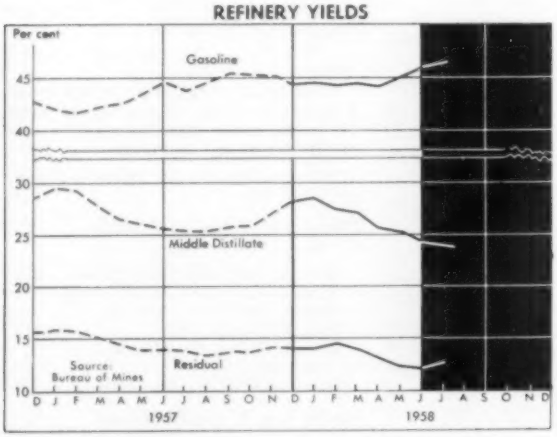
TOTAL DEMAND - MAJOR PRODUCTS



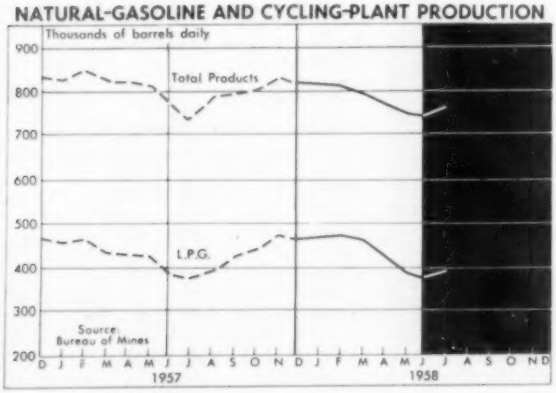
PRODUCTS DELIVERED BY PIPELINE



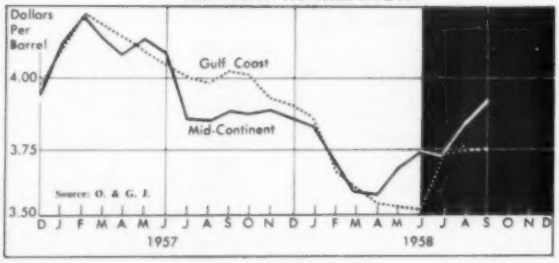
REFINERY YIELDS



NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



REFINERY REALIZATION



REFINERY REALIZATION

	September* 1958	August* 1958	July 1958	September 1957
Mid-Continent	$3.94	$3.85	$3.81	$3.88
Gulf Coast	3.75	3.75	3.68	4.02

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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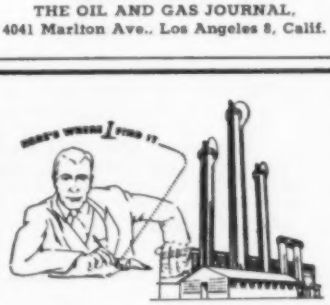

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SEALED BIDS will be received until 2:00 P.M. Mountain Standard Time, October 28, 1958, and opened at that time in the Office of the Uintah and Ouray Indian Agency, Fort Duchesne, Utah, for the leasing of 33,874.53 acres of Tribal land and 1,020.6 acres of allotted Indian land, located in Townships 2 and 3 South, Ranges 3, 4, 5 and 6 West, Duchesne County, Utah, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Uintah and Ouray Indian Agency, at Fort Duchesne Utah.

LEGAL

SEALED BIDS will be received until 10:00 A.M., Mountain Standard Time, October 22, 1958, and opened at that time in the office of the Navajo Indian Agency, Window Rock, Arizona, for oil and gas leases on 85 tracts of allotted lands, totaling approximately 13,551 acres, located in McKinley, San Juan and Sandoval Counties, New Mexico.

Details of the lease offering and filing of bids may be obtained by addressing an inquiry to the General Superintendent, Navajo Indian Agency, attention: Branch of Realty, Window Rock, Arizona.
Sale #59.

Statement of the Ownership, Management, Etc., of
THE OIL AND GAS JOURNAL,
October 13, 1958

(This statement is published in compliance with the Act of August 24, 1912).

Published weekly (Monday) at Tulsa, Okla.

Publisher: The Petroleum Publishing Company, Tulsa, Okla.

Editor: George H. Weber, Tulsa, Okla.

Business Manager: S. H. Rourke, Tulsa, Okla.

The owner is: The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 1, Okla.

Stockholders holding 1 per cent or more of total amount of stock: Helen B. Lauinger, Tulsa, Okla.; P. C. Lauinger, Tulsa, Okla.; Edward P. Boyle, Oil City, Pa.

Known bondholders, mortgagees and other security holders holding 1 per cent or more of the total amount of bonds, mortgages or other securities: None.

The average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was 40,090.

S. H. ROURKE,
Business Manager.

Sworn to and subscribed before me this 30th day of September, 1958.

ROBERT D. FUNK,
Notary Public.

My commission expires April 19, 1959.

LEGAL

NOTICE TO BIDDERS

Sealed proposals in duplicate, addressed to the City Commission, City of Port Arthur, Texas, will be received at the office of the City Clerk until 9:00 o'clock A. M., October 22, 1958, and then publicly read at 10:00 o'clock A. M. on the same date for the leasing for a period of time not exceeding three (3) years for oil and gas the following described tract of land, the same being located in the County of Jefferson, Texas and within the Corporate Limits of the City of Port Arthur: Lots 1, 2, 7 & 8, Block 8, Range M of the Port Arthur Land Co Lots 2, 3, 4, 5 & 6 Block 8, Range L of the Port Arthur Land Co. Proposals shall contain the provisions that no well or wells will be drilled on any part of said above described property that is covered by water and that any well or wells drilled beneath that part of said property covered by water will be drilled by the use of directional drilling and shall in no way injure the water contained in the reservoir located on City Property. Each Proposal shall be accompanied by a certified check drawn on a bank acceptable to the Owner, or bidders bond from a surety company acceptable to the Owner, in an amount not less than 5% of the total bid price, payable without recourse to the City of Port Arthur as a guaranty that the successful bidder (s) will enter into a lease contract. Successful bidders shall furnish an indemnity bond indemnifying the City of Port Arthur for any loss or losses, damage or damages that might be sustained by reason of the drilling of a well or wells on or under said property. Bid sureties will be returned to all but the highest and best acceptable bidder within five (5) days after opening of bids and the successful bid sureties will be returned within twenty-four (24) hours after the execution of the lease contract. The City of Port Arthur as Owner reserves the right to reject any or all bids. Ernest W. Meyer, City Clerk.

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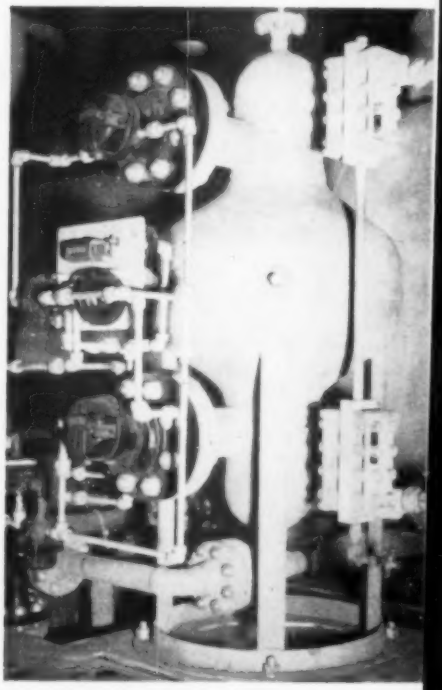

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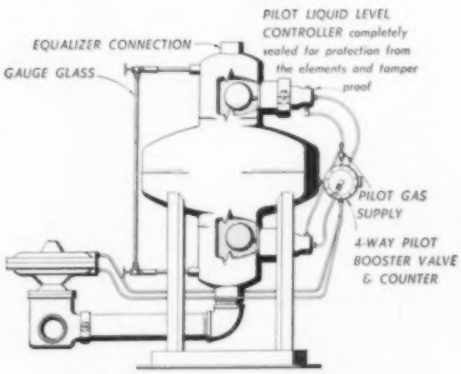
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TULSA, OKLAHOMA

Dowell Guide to Acidizing

1. Paradox Lime
San Juan County, Utah

1. This formation is both vugular and highly soluble. Good results often occur after a wash of Mud Acid, followed by Retarded Acid or regular acid with surface tension and emulsion control agents added. Acid volumes range from 1500 to 10,000 gallons or more. *Wells often potential more than 1000 bopd.*

2. Noodle Creek Lime
Jones County, Texas

2. This vugular pay reacts quickly with regular acid. For this reason an acid with retarded action has been used. Typical treatment is 250 to 500 gallons regular acid containing surface tension, anti-emulsion and silicate control agents, followed by 1000 to 5000 gallons of the slow reacting fluid used in Acid Petrofrac®. *Wells producing from 16 to 45 bopd often increase to 80 to 125 bopd.*

3. Chester Lime
Beaver County, Oklahoma

3. Reaction time is usually less than one minute in regular acid. As a result, Retarded Acid is usually recommended. The following three-stage treatment has proved successful: (1) 500 gallons Mud Acid; (2) 500 gallons regular acid with surface tension and anti-emulsion agents added; (3) 5000 to 20,000 gallons Retarded Acid injected at rates up to 30 bpm. *Some previously non-commercial wells have potentialed 20 million cfd after treatment.*

4. Townsend Wolfcamp
Lea County, New Mexico

4. This dolomitic limestone is found from 10,400 to 11,100 feet. Some sections have crystalline porosity. Some are fossiliferous, and some are vugular. Treatment with either 10,000 gallons Retarded Acid or 3000 to 20,000 gallons regular acid has been successful. A wash with Mud Acid ahead of the main treatment is recommended. *Wells have potentialed 300 to 500 bopd after treatment.*

5. Mississippian Lime
Southeastern Saskatchewan

5. Many new wells in the Midale Beds get good drill stem tests, but produce only a show. Treatment is often a 500 gallon wash of Mud Acid followed by 500 to 2000 gallons Dowell regular acid with anti-emulsion, surface tension, and silicate control agents added. Injection pressures are held to 1000 psi or below to minimize water troubles. *After treatment, wells have potentialed 80 to 100 bopd.*

6. This flashy formation reacts fast with regular acid, so Dowell has used Retarded Acid to increase penetration, drainage area and production. Typical treatment is 500 gallons Dowell acid with surface tension and de-emulsifying agents added, followed by 3000 to 4000 gallons Retarded Acid. *Potentials are often increased from a show to 240 bopd.*

With 41 different acid addition agents to choose from, Dowell engineers can help you "tailor" the best acid treatments to the requirements of your well. Call your nearest Dowell engineer. Let him tell you how Dowell acidizing services have helped other operators in your area get higher production from their wells. Have Dowell acidize your wells. Dowell, Tulsa 1, Oklahoma.

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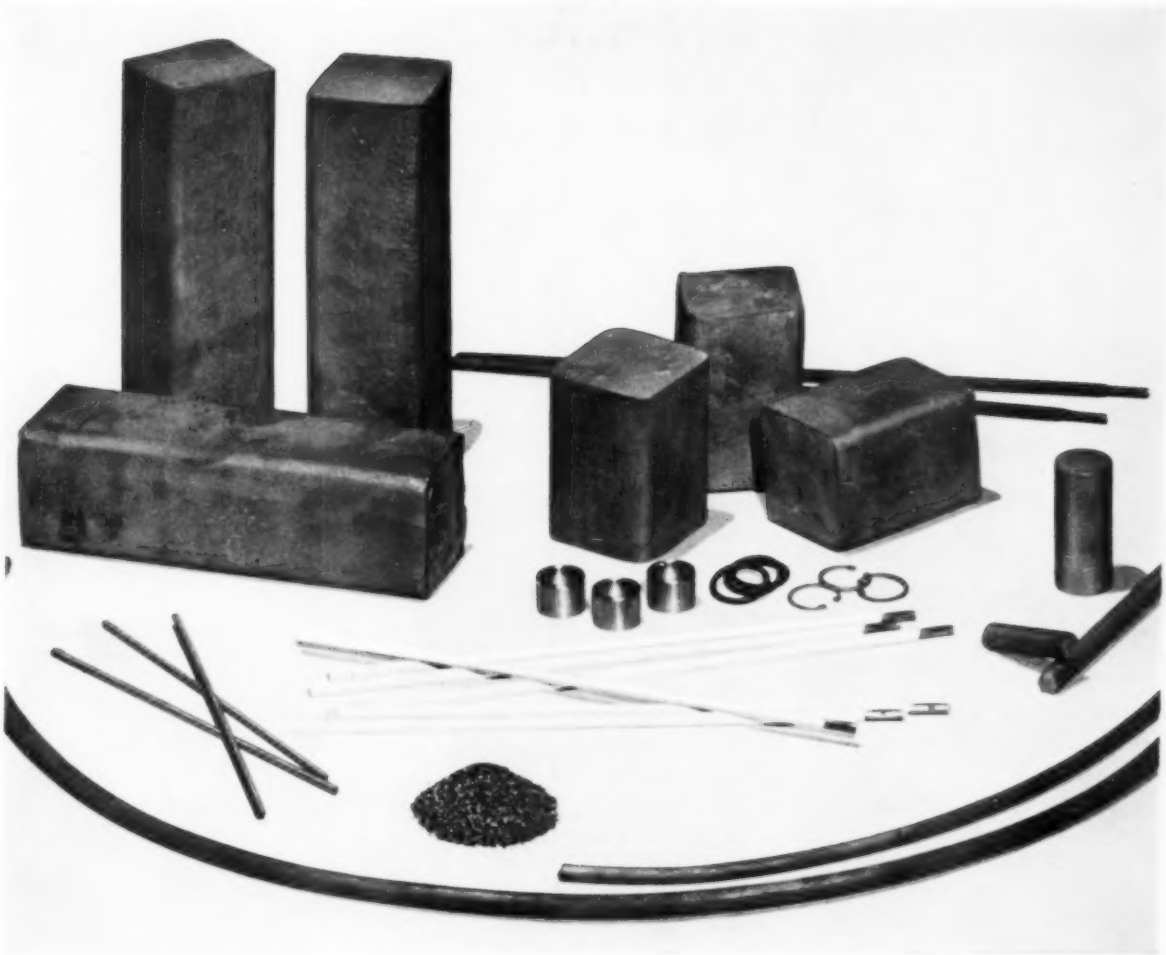
6. Lansing-Kansas City Lime
Barton County, Kansas



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